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NUCLEAR SCIENCE ABSTRACTS

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ABSORPTION AND SCATTERING OF RADIATION

1868 Papers for Plutonium Project Record Vol 9B Chap 2, 3, 6 ed by N Sugarman. AECD-2559 nd Decl Apr 5 1949 138 p For publication in NNES

The individual papers of this document are abstracted below.

1869 Angular Dependence of β-Ray Intensity from Radioactive Sources by N Elliott, D W Engelkemeir and W Rubinson. AECD-2559-A nd Decl Apr 5 1949 17p

The distribution of radiation from β-active sources of various weights has been examined to test the validity of geometry standards. A 1 cm^2 U metal foil source showed a $1/r^2$ decrease in activity at distances > 5.8 cm from the G. M. tube window. A comparison was made of the geometry given by U metal foil, uranium oxide and $UX_1(Th^{234})$ + $UX_2(Pa^{234})$ carried on cerium fluoride with that calculated from counter window area and source distances. Ratios of geometries obtained were 2.11, 1.48, and 1.01 respectively, indicating larger forward scattering contributions from the source of larger weight. Observations of the dependence of measured activity upon the angle between the planes of the source and the counter window showed that the radiation from sources becomes isotropic as the source weight becomes very small.

1870 An Analysis of β-Ray Scattering Phenomena in Sources and Absorbers by N Elliott and E Shapiro. AECD-2559-B nd Decl Apr 5 1949 9p

By assuming that at ordinary distances apart the effects of finite source and counter window size will be small compared to the effect of scattering by an absorber between the source and counter, expression for the measured activity as a function of the absorber-counter distance can be developed. Three cases are treated: (1) radiation emission from the source and scattering by the absorber are isotropic; (2) radiation emitted from the source is isotropic, but scattering by the absorber follows a cosine law; (3) radiation emission from the source and scattering by the absorber both follow cosine laws. Case (1) does not measurably occur in the ordinary counting apparatus. Case (2) agrees very well with results obtained using a thin source. Case (3) agrees very well with results obtained using a thick source.

1871 An Analysis of the Effects on Absorption Curves of Scattering of β-Radiation by Absorbers by T B Novey and N Elliott. AECD-2559-C nd Decl Apr 5 1949 15p

A number of changes in the shape of Al absorption curves caused by variation in experimental arrangements are demonstrated, and explanations for these effects are advanced on the basis of scattering of the primary β-radiations. Radiation measured after reflection from an Al plate was found to be degraded in energy by a factor of two. The standard Al source-holder and G. M. tube-holder were found to cause no appreciable increase in counting rate due to scattering from their surfaces. Maxima occuring in Al absorption curves, when source and absorbers are close together but both are several centimeters from the counter window, are well predicted by simple scattering and absorption laws. Soft components in Al absorption curves when the source is several centimeters from the counter and backed with Al and the absorbers are placed close to the counter agree with results predicted from observations on the degradation of β-radiation by scattering from an Al plate. The effect of air scattering on Al absorption curves is demonstrated in a series of curves performed in H_2 and air atmospheres.

1872 Investigation of the Effects on β-Counting of Self-Scattering Due to Source Weight by D W Engelkemeir, J A Seiler, E P Steinberg and L Winsberg. AECD-2559-D nd Decl Apr 5 1949 15p

The effect on counting rate of variation of source weight while keeping the source disintegration rate constant has been investigated. A series of graphs is presented from which factors can be directly obtained that will correct the counting rate of a source weighing up to ~ 40 mg/cm^2 mounted on cardboard to a counting rate of a source with the same disintegration rate but with zero weight and no backing. The data are presented for 8 different maximum β-energies ranging from 0.15 to 2.5 Mev. The incorrectness of the classical corrections is demonstrated.

ABSORPTION AND SCATTERING OF RADIATION (continued)

1873 Variation of the Amount of Backscattering with Thickness and Atomic Weight of the Backscatterer for β-Radiation of Several Maximum Energies by D W Engelkemeir, J A Seiler, E P Steinberg, L Winsberg and T B Novey AECD-2559-E nd Decl Apr 5 1949 8p

Data are presented on the backscattering contributions to counting rates for sources emitting β-radiation of different maximum energies and for backscatterers of different weight and atomic number. The maximum amount of backscattering is reached at one-fifth the range of the β-radiation The maximum amount is independent of the β-energy above 1 Mev but falls off below this energy. The maximum contribution rises with the atomic number of the backscatterer. Changing the distance of the source from the counter is found to have only a small effect on the backscattering contribution.

1874 Theoretical Study of β-Absorption Curves and Correlation with Feather Method of β-Energy Determination by T B Novey, E P Steinberg, N E Ballou, G W Campbell and L Winsberg. AECD-2559-F nd Decl Apr 5 1949 5p

Using the expression for the probability for the emission of electrons of energy in the range E to E+dE as given by the Fermi theory of β-disintegration, distribution curves for spectra of 0.5, 1, 2 and 3 Mev maximum energy were calculated, and the most probable and average energies were determined, being 0.4 and 0.42 of the maximum energy respectively. By dividing the spectrum into small energy intervals and treating the probability value of the interval as the intensity of a monoenergetic electron beam of that energy, a series of monoenergetic electron linear curves are obtained which upon summation give a synthetic absorption curve for the spectrum. A curve of this type was calculated for a 1 Mev maximum energy β-spectrum. Upon applying a Feather analysis to this curve the extrapolated range gives a value of 0.98 Mev in excellent agreement with the assumed energy.

1875 Preparation of Absolute β-Counting Standards by T B Novey, D W Engelkemeir and P S Levy. AECD-2559-G nd Decl Apr 5 1949 11p

Procedures for the preparation of weightless RaE (Bi^{210}) and UX_2(Pa^{234}) β-geometry standards and reference standards are given. The RaE calibration is made by measuring the growth of RaF (Po^{210}) α-activity in a pure RaE source. The UX_2 calibration is made by the quantitative separation of the UX_1 + UX_2 activity on a small amount of carrier from a known amount of natural U. Geometries given by these sources are in excellent agreement. Comparison of results given by these standards with those given by an Anderson-Roberts RaE standard has been made.

1876 A Correlation of Methods for the Determination of Absolute Neutron Flux by T B Novey. AECD-2559-H nd Decl Apr 5 1949 8p

A comparison of the thermal neutron flux values given by two types of measurement is given. The procedures described and used are based on (1) neutron emission from a calibrated Ra-Be source, and (2) β-activity induced in a Au foil. A series of simultaneous measurements of neutron flux show large disagreement among the values obtained from each method. Flux values given by the methods are in the ratios of 1:1.42.

1877 The Relationship between the Range and Spectrograph Energy of β-Particles by L E Glendenin and C D Coryell. AECD-2559-I nd Decl Apr 5 1949 10p

The Feather range-energy relationship is re-examined in the light of more recent magnetic spectrograph studies of thirteen β-spectra, and two new relationships are presented for the range of 0.1 to 3 Mev maximum β-energy. For $R > 0.3$ gm/cm^2, $E_m = 1.85\ R + 0.245$ Mev. For $0.02 < R < 0.3$ gm/cm^2, $E_m = 1.92\ R^{0.725}$ Mev.

ABSORPTION AND SCATTERING OF RADIATION (continued)

1878 The Chemical Effects of Nuclear Transformation: β-Decay of La to Ce, Mass 143^+ by H Gest, R R Edwards and T H Davies. AECD-2559-J nd Decl Apr 5 1949 8p

The formation of ceric ion from the decay of trivalent La^{143} has been demonstrated by the use of zirconium iodate as a specific carrier for Ce^{IV} in the presence of Ce^{III}. Of the Ce^{143} formed in the presence of the carrier-precipitate $\sim$ 57 percent was captured presumably as ceric ion. Since poor reproducibility was encountered in the test experiments, the failure of the remaining $\sim$ 43 percent to carry cannot be definitely explained. The results serve as an experimental demonstration of the oxidation expected as a result of electron (β-particle) emission from an unstable nucleus.

1879 Estimates of the Amount of Radiation and Accompanying Energy Liberation from Fission Products by L B Borst. AECD-2559-K nd Decl Apr 5 1949 7p

A preliminary investigation has been made of the intensity of β- and γ-radiation produced by the non-gaseous products of the fission of U. The total products were concentrated into a sample which contained a very small fraction of the original U and the decay curves were obtained with a Lauritsen quartz fiber electroscope using various Pb absorbers. The curves were followed until it was no longer possible to obtain consistent values of the γ-activity. Radium and UX standards were used to calibrate the electroscope, in order to express the results as curies of β- and γ-radiation per U fission. Following these preliminary experiments more extensive measurements were made with more active samples. On the basis of the data obtained in this study, calculations have been made by J. A. Wheeler (Wheeler and Borst, CL-697) showing the energy liberation as a function of time of irradiation and of cooling time and also in the form of the time decay of energy liberation associated with one gram of fission products formed in various times.

1880 Beta Decay and Energy Liberation from U Following Intermediate Irradiation Times by J D Knight. AECD-2559-L nd Decl Apr 5 1949 17p

Samples of U were irradiated for 1 hour in the pile, and β-decay and absorption curves were taken for periods from 0.5 hour to 96 days. From analyses for Ba^{140} the decay curves at zero absorber have been transformed to curies per gram of fission products. A study was made of the empirical relation existing between half-thickness $T_{\frac{1}{2}}$ (in mg/cm^2), of the approximately exponential absorption curves and average energy, E_{av} (in Mev), of the β-emitter, leading to the result: $E_{av} = 0.0072\ T_{\frac{1}{2}}$. Using this relation, the absorption curves at various times of decay have been analyzed empirically to give the power in watts in the β-radiations from one gram of fission products over the range of time of 0.5 hour to 96 days.

1881 A Comparison of Gross Fission Product Decay with Decay of the Sum of the Separated Fission Products by C D Coryell, E L Brady, N E Ballou, W H Burgess, G W Campbell, D W Engelkemeir, L E Glendenin and T B Novey. AECD-2559-M nd Decl Apr 5 1949 6p

An experimental survey of the β- and γ-emission from separated long-lived fission products as compared with that from a sample of unseparated fission material has been made. It was found that the sum of the individual β-activities satisfactorily accounted for the observed gross activity up to 150 days after the end of the irradiation and the γ-sum gave satisfactory activity balances up to 90 days. After these times the percentage accounted for dropped to 90-94%.

1882 Energy Loss of Deuterons in D_2O at Very Low Energies by A P French and F G P Seidl. AECD-2569 (LAMS-392; LADC-161) June 24 1946 Decl Apr 18 1949 22p

In this paper the rate of energy loss of deuterons in a D_2O (heavy ice) target is deduced for the special case of very low bombarding energies (10 to 100 Kev) from existing experimental evidence. It is concluded that this problem demands much closer investigation, and that until this is done any statements on the energy-loss process are bound to be largely conjectural.

ABSORPTION AND SCATTERING OF RADIATION (continued)

1883 Angular Distribution of Protons from Photo-Disintegration of the Deuteron by N O Lassen Phys Rev 75 1099 (1949 April 1 (Letter to the editor)

The results previously reported [Phys Rev 74 1533 (1948)] on the angular distribution of protons from the photo-disintegration of the deuteron by Na^{24} gamma-rays have been modified, since the influence of the finite solid angles was somewhat underestimated. By applying the noted correction, the ratio between the photomagnetic and photoelectric effects has been determined as 0.26 and the value $\sigma_{0°}/\sigma_{90°} = 0.15 \pm 0.03$. These results are in agreement with theoretical expectations (L Hulthén, private communication). It is noted that further, more accurate, investigations are in progress to enable discrimination between the results to be expected from various assumptions regarding the nuclear forces.

1884 Boundary Conditions and Range of Force for S State of Two Protons by G Breit and W G Bouricius Phys Rev 75 1029-1050 (1949) Apr 1

The objectives of the work presented in this paper are the following: (1) To investigate on an empirical basis the possibility of replacing the potential energy point of view for proton-proton scattering by boundary condition requirements; (2) to systematize the treatment of theoretically expected proton-proton scattering by bringing out the way in which different compact potential energy curves can give similar results and to make available convenient ways of adjusting the nuclear potential well parameters to experimental data. The possibilities of describing phase shifts by means of a boundary condition at a distance small compared with $e^2/mc^2 = 2.8 \times 10^{-13}$ cm are discussed. It is noted that the irregular solution of the wave equation in a Coulomb field has a logarithmic infinity which masks the features of the wave function which have to do with phase shifts and therefore with observation. The boundary conditions at moderate distances are studied and it is found that the "potential energy curve" description can be replaced by the requirement that the logarithmic derivative of the wave function have an energy-independent value at a distance of $\sim 0.47\ e^2/mc^2$. Similarly the ^1S proton-neutron interaction can be approximately described by requiring the logarithmic derivative to have an energy independent value at $\sim 0.49\ e^2/mc^2$. In the convention of dealing with "distance times radial function" the values of the logarithmic derivatives are ~ 0.08, 0.06 for the proton and neutron cases, respectively.

It is also possible to require a linear variation of energy for the logarithmic derivative within limits and to retain agreement with experiment. It is noted that theoretical arguments for considering a failure of the potential energy viewpoint exist and that the agreement of the boundary conditions at moderate distances with observation may be more than an accident. The adjustment of the range of force is treated and evidence for a somewhat smaller value than 2.8×10^{-13} cm, perhaps 2.6×10^{-13}cm is discussed. (Simple relationships between effective depth variation with energy and range are used.) Finally, the function f of BCP is expanded in powers of energy E, the relations for potential energy curves of different shapes are taken up regarding equivalence of range, the deviations from linearity of f with E are discussed from the viewpoint of equivalent error in scattering, and a rapid procedure for finding the equivalent square well range by means of successive approximations is given.

1885 Experimental Determinations of Stopping Powers Using Alpha-Particles of 15 to 37 Mev by E L Kelly Phys Rev 75 1006-0017 (1949) Apr 1

This article is based on AECU-54 (UCRL-208). An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. 2-373.

ATOMIC POWER AND NUCLEAR REACTORS

1886 U. S. Lights New Atomic Pile for Peace by Martin Mann Popular Sci 154 No. 4, 121-128 (1949) Apr

Some of the features of the Brookhaven National Laboratory's new atomic pile are described and a scale model of the pile building is shown. A detailed sketch illustrates some of the pile's unique features such as the pneumatic tubes which will be used to transport "hot" materials from the pile and the tunnels beneath the pile which will be used for the experimental irradiation of animals. An "atom's eye view" of the pile from the inside is also shown. 7 photographs.

BIOLOGICAL EFFECTS OF RADIATION

1887 A Distributed Type Source for Exposing Biological Materials to Gamma Rays by C W Sheppard. AECD-2566 Feb 15 1949 Decl Apr 18 1949 44p

A method is described by which small amounts of tissue (or water) equivalent biological materials may be exposed to uniform intensities of gamma rays. A cylindrical foil of gold is used containing the radioactive isotope Au^{198} of half life 2.70 days. The space inside the cylinder contains polystyrene except for the region occupied by the sample. In this way a uniform absorption of radiation is achieved uncomplicated by any discontinuities. Calculated and measured intensity variations in the region near the center of the cylinder are in good agreement.

1888 The Effects of Roentgen Rays on Adult Rainbow Trout by Arthur D Welander, Lauren R Donaldson, Richard F Foster, Kelshaw Bonham, Allyn H Seymour and Frank G Lowman. AECU-188 (UWFL-17) nd 20p

Nearly mature adult rainbow trout were subjected to 25 MA, 200 KV, copper and aluminum filtered X-rays of 50, 100, 500, 750, 1000, 1500, and 2500 r at 8.25 r per minute. A total of 148 fish was used in the experiment which lasted 64 weeks. When compared with an unirradiated control group mortalities were significantly higher in fish exposed to 1000 r or more. Doses of 2500 r killed all fish in a period of 13 weeks with the majority dying during the 8th week. Exposures to 1500 r killed 56 per cent in 13 weeks and 87 per cent in 64 weeks. Mortality in the controls was 15 per cent. Injuries symptomatic of radiation were seen in autopsied fish treated with 500 r or more. The injuries, such as hemmorhage, necrosis, growth of fungus and intestinal damage were generally proportional to the amount of X-ray given. Growth in length and weight was retarded in all irradiated groups as compared with controls. The growth increment during the fastest growing period of the experiment was significantly less in a fish irradiated with 750 r or more and proved to be a sensitive measurement of radiation damage and directly proportional to the amount of radiation given.

1889 The Effect of Roentgen Radiation on the Production of Thoracic Duct Lymphocytes by William N Valentine, Charles G Craddock and John S Lawrence Amer J Med Sci 217 379-382 (1949) Apr

This article is based on AECD-2023. An Abstract of the the document has been listed in Abstracts of Declassified Documents 2 346 (1948) June 30.

1890 Examination of the Target Theory by Deuteron Bombardment of T-1 Phage by Ernest C Pollard and Frederick Forro Jr Science 109 374-375 and 386 (1949) Apr 15

The authors investigate the target theory of biological action, according to which a localized sensitive volume of definite size exists and within which there must be considerable liberation of energy for biological action to take place. Although Lea has examined the theory [Brit J Radiology, suppl. 1, p. 35 (1947)], according to his views a specimen irradiated in high concentration, and in the presence of a high concentration of large molecules, should have a low efficiency for indirect action and the direct, target-type action should predominate. Since there is some question as to whether direct action ever occurs, the target theory has been investigated in deuteron bombardments in which it should certainly be valid; these were made using T-1 bacteriophage. Tabulated data on the percentage survival as a function of the number of deuterons per unit area are given for beam energies of 1.5, 2.5, and 3.5 Mev. Tabulated data on the temperature inactivation of the same phage are given; these data suggest that Lea's theory should be modified to include the possibility of inactivation caused by secondary radiation reaching the target from an ion path which does not go through the target. This is developed mathematically and the results obtained indicate that the data are consistent with the following hypotheses: 1) a target of $28 \pm 4 m\mu$ exists which is much smaller than the phage itself, and 2) the measured target size is greater than the true target size owing to the fact that radiation from the path of a deuteron which misses the target can inactivate the phage.

BIOLOGICAL EFFECTS OF RADIATION (continued)

1891 Hypothromboplastinemia Following Total Body Irradiation by William D Holden, Jack W Cole, A F Portmann and J P Storaasli Proc Soc Expt! Biol and Med 70 553-556 (1949) Mar

Determinations of the hemoglobin, erthrocyte count, leucocyte count, platelet count (blood smears, 2.5% sodium citrate), clotting time, protamine titration where indicated, and thromboplastin assay of dogs subjected to total body irradiation were made prior to, and on successive days following, irradiation. Healthy mongrel dogs were irradiated with 450 r (LD-100%) from a 22 K.V.P. machine at 15 ma through a 0.5 mm copper filter and a 1.0 mm aluminum filter, at a rate of 6-7 r per minute. The results obtained are given in tabular and graph form. A hemorrhagic syndrome was produced which was manifested by multiple areas of hemorrhage in the pulmonary, gastrointestinal, and urinary systems, anemia leucopenia, thrombocytopenia, prolongation of clot retraction, and hypothromboplastinemia.

1892 Nucleic Acid Content in Intestines of Rats after Neutron Radiation by J O Ely and M H Ross Cancer Research 8 607-612 (1948) Nov

It was reported in a previous paper [Cancer Research 8 285 (1948)] that whole-body X-radiation of rats resulted in decreased amounts of desoxyribonucleic acid, ribonucleic acid, structural proteins, and non-volatile ash in the cells of the crypts of Lieberkühn in the intestines. Studies on the effects of whole-body neutron irradiation of rats on the crypts of Lieberkühn have been made using ultraviolet absorption and chemical staining methods. It was found that neutron radiation caused a decreased ultraviolet light absorption in the crypts of Lieberkühn in the duodenum of rats; the decrease was found at various periods of time ranging from 4 to 48 hours after irradiation. The effects produced increased with the dosage and the decreased ultraviolet absorption has been linked with ribonucleic acid and desoxyribonucleic acid. It was also found that the amount of inorganic ash was reduced. These effects of neutron radiation are similar to those previously found after whole-body exposure to X-rays.

CHEMISTRY, ANALYTICAL

1893 The Coseparation of Aqueous Fluozirconate Ion with Solid Lanthanum Fluoride by H Gest, W H Burgus and T H Davies. AECD-2560 (ANL-NS-243) nd Decl April 18 1949 21p For publication in NNES

Using Zr^{95} as a radioactive indicator, surface adsorption was found to be primarily responsible for the coseparation of Zr with both (a) externally and (b) internally formed LaF_3 in 1 M HNO_3, 0.5 M HF. The adsorption was found to be reversible, to be independent of the concentration of F^- from 0.1 to 1.0 M and of HNO_3 from 0.3 to 1.0 M, and to be unaffected by temperature from 27°to 70°C. When the assumption was made that Zr is adsorbed as the complex ion, $ZrF_6^=$, with a cross-section area of 36.5 sq. A , it was possible to calculate a specific surface of 58.3 m^2/gm for the LaF_3 from the observed saturation adsorption of 14.6×10^{19} fluozirconate ions per gram. This value compared favorably with that of 59 m^2/gm determined by the van der Waals adsorption of N_2 at −195.8°C.

1894 Paper Chromatography of Purine and Pyrimidine Derivatives of Yeast Nucleic Acid by C E Carter. AECU-189 (ORNL-313) Apr 11 1949 20p

Solvent systems for paper chromatography of purine and pyrimidine derivatives of yeast nucleic acid are described and the use of the method for analysis of complex mixtures of these compounds by two-dimensional chromatography are reported. Location of compounds on the paper chromatogram is achieved by ultraviolet fluorescene. It has been found that the adenylic acid derived from yeast nucleic acid is resolved by chromatographic procedures into two components which may be chemically and enzymatically degraded to adenine and adenosine. It is therefore suggested that the two adenylic acids are isomers with respect to the location of the phospohric acid moiety on the ribose chain: adenosine-2-phosphoric acid and adenosine-3-phosphoric acid.

CHEMISTRY, ANALYTICAL (continued)

1895 The Separation of Antimonic Chloride from Antimonious Chloride by Extraction into Isopropyl Ether by Frank C Edwards and Adolf F Voigt. AECU-192 (ISC-38) Feb 1949 10p

The distribution of +5 Sb and +3 Sb between hydrochloric acid solutions and isopropyl ether has been studied for various concentrations of acid and antimony. An extremely rapid equilibrium results in a quantitative extraction of +5 Sb over the acid range 6.5 to 8.5 M with a pseudo-distribution coefficient greater than 200. The distribution coefficient for the extraction of +3 Sb in 0.016. A procedure using two distributions will quantitatively and rapidly separate +5 and +3 Sb.

1896 Dynamics of Ion Exchange (Dinamika ionnogo obmena) by E N Gapon and T B Gapon Zhur Prikladnoi Khim 21 937-947 (1948) Sept (In Russian)

The dynamics of sorption from solutions, unlike that of vapor sorption, has been inadequately studied. In the present work a theory is given of these processes for the particular case of ion exchanges. If two ions are being exchanged between a solid adsorber and a solution, the increase of the molar part of one of the ions in the adsorbed state is determined by the following factors: the exchange constant, the initial molar parts of the ion in question in the adsorbed state and in the solution, and the ion ratio, i.e., the ratio of the absolute number of the exchanging ions in the solution to that of the exchanging ions in the adsorber. On the basis of this ratio a classification of ion exchange columns can be made: isoionic column (ion ratio = 1); hyperionic columns (<1), and hypoionic columns (>1). A method is shown for an approximate computation of sorptional distributions of two ions. For the case when the ionic ratio is equal to 1, there exists a linear relationship between the volume of the solution (of a given concentration) which has passed through the column, and the weight of the adsorbent (of a given adsorption capacity). This relationship has the same physical meaning as a similar equation in the dynamics of vapor adsorption, as derived by Shilov et al. [Zhur Russkogo Khimicheskogo Obshchestva 61 1107 (1929)]

CHEMISTRY, GENERAL

1897 Preparation of the Disodium Salt of 1-(o-Arsonophenylaze)-2-naphthol-3,6-disulfonic Acid ("Thoron") by Sherman A Reed, Carol H Byrd and Charles V Banks. AECD-2565 nd Decl Apr 18 1949 5p Proposed for publication in J Amer Chem or J Org Chem

This report gives a detailed procedure for the preparation of "thoron", a reagent of considerable importance in the analytical chemistry of thorium. The synthesis is carried out in three separate steps: (a) the coupling of o-nitroaniline with disodium hydrogen arsenite by the Bart reaction to form o-nitrophenylarsonic acid, (b) the reduction of o-nitrophenylarsonic acid to o-aminophenylarsonic acid with ferrous chloride, and (c) the coupling of the o-aminophenylarsonic acid with 2-naphthol-3,6 disulfonic acid (R salt) by the Greiss reaction.

COSMIC RADIATION AND MESONS

1898 The Altitude Curve of Heavy Particles Produced by Cosmic Rays (Vysotnyĭ khod dlya tyazhelykh chastits, vyzyvaemykh kosmicheskimi luchami) by G E Belovitskiĭ and L V Sukhov Doklady Akad Nauk SSSR 62 207-210 (1948) Sept 11 (In Russian)

By the method of photographic emulsions, the relationship was studied between the number of heavy particles generated by cosmic rays and the altitude. The various sources of photo-regression were taken into account; it was found that the regression could be reduced considerably by keeping the plates in a 1 mm Hg vacuum. The altitude range was 200-6000 m, the exposition time varied from 26 to 55 days. For tracks longer than 10 cm air equivalent, and for an altitude range 900-6000 m, the number of particles S is given by $S = ce^{-mp}$, where p is the pressure in atm., and $m = (6.0 \pm 1.2)$ atm^{-1}. The effective cross section of the absorption of the generating particles by nuclei of oxygen and nitrogen is $m/N = (1.4 \pm 0.3)10^{-25} cm^2$, ($N = 4.3 \times 10^{25}$ is the number of nuclei in a vertical column of air resting on 1 cm^2 of the earth's surface). Tracks of different lengths have different altitude rates:

COSMIC RADIATION AND MESONS (continued)

thus, in the interval 900-6000 m the number of tracks of 10-20 cm air equivalent increases 8 fold, while the number of tracks exceeding 20 cm increases 12 fold. All these data differ from those obtained by Widhalm (Z Physik 115 481 (1940)). For "stars" the same value of m ($\simeq$6 atm^{-1}) was found; this points to a genetic relationship between heavy particles and stars. Since most of the tracks cross the emulsion, the heavy particles must originate in the glass of the plate or in other surrounding objects. The track distribution is isotropic. At 3860 m the intensity of the generating component is probably several times that of the hard component of the cosmic radiation.

1899 Angular Distribution, Frequency and Absorption of Slow Single Cosmic Ray Protons by S Lattimore Phil Mag 40 394-404 (1949) Apr

Data on the angular distribution, frequency, and absorption of slow single cosmic ray protons have been taken using plates of Ilford 100 μ C2 emulsion on glass 1 mm thick which were exposed at an altitude of 3600 meters above sea level. The absorption of the protons in the atmosphere and in ice at various altitudes was also determined. The theoretical calculations for two cases, i.e., 1) horizontal plate, and 2) vertical plate, are outlined. The data obtained are presented in curves and tabular form and it is noted that the number of slow protons observed is too great for exclusive production by stars similar to those observed in the emulsion. The results obtained are discussed in detail and it is suggested that the excess of protons noted may be produced by disintegrations and possess a higher energy than those emitted by the stars observed. In addition, the angular distribution obtained experimentally indicates that these protons are strongly collimated in a downward direction. It is estimated that the protons which were observed have an approximate range of 4200 μ which corresponds to an energy of 32 Mev at production. These results are consistent with the assumption that the protons are produced with sufficiently high energies for those starting in the emulsion to be unobserved. The rate of production per unit volume of these fast protons has been calculated to be 62/cc/day.

1900 Coincident Bursts in Small Ionization Chambers by C G Montgomery and D D Montgomery Phys Rev 75 980 (1949) Mar 15 (Letter to the editor)

Previous investigations which have indicated that many of the bursts of ionization occurring in a large, unshielded ionization chamber result from nuclear disintegrations within the chamber [Phys Rev 72 131 (1947); Bridge, et al. Phys Rev 74 1083 (1948); Carmichael, Phys Rev 74 1667 (1948)], have been extended to smaller chambers. Data have been taken on simultaneous bursts occurring in two spherical chambers, 3 inches in diameter, and on coincidences between bursts and the discharges of a counter set that detected electrons in air showers. A pressure of 200 lbs./in^2 of argon was used and the bursts were recorded photographically by means of an electrometer tube, a galvanometer, and a motor-driven camera. The observations, which were made both at sea-level and at 3500 meters, indicate that the size-frequency distribution of the bursts is approximately a power-law distribution with an exponent which increases slightly with increasing burst size. For the integral distribution the exponent is about 3. After discussing the results it is concluded that the bursts must be explained by postulating heavily ionizing particles of long enough range to bring them within the high field region of the chambers, i.e., protons, fast α-particles and slow mesons.

1901 The Density Spectrum of Extensive Air Showers of Cosmic Rays by G Cocconi and V Cocconi-Tongiorgi Phys Rev 75 1058-1062 (1949) Apr 1

The density spectrum of extensive showers as measured both at 260 and at 3260 m above sea level is not a pure exponential at either altitude. Previously it has been established that the frequency $H(\Delta)$ of the extensive air showers in which the particle density (particles per unit surface) is greater than Δ can be satisfactorily expressed by the law: $H(\Delta) = K\Delta^{-\gamma}$, where K and γ are in first approximation constant in a large density range and vary with the altitude above sea level. From the data which are given in tabular form, it is concluded that: 1) γ increases with the density of the showers and 2) the variation of γ with Δ implies a dependence of the constant K on Δ. Within the density range of 10-1000 particles/m^2, the following values were found to give the best fit with the experimental points: 1) at 260m, K=0.200 and γ =1.48, 2) at 3260 m, K = 1.68 and γ = 1.46. The data indicate the complexity

COSMIC RADIATION AND MESONS (continued)

of the variation of γ with altitude, since γ decreases with altitude for showers of density less that 10^3-10^4 m^{-2} and increases with altitudes at greater densities. The results obtained are compared with those obtained by previous workers and with the theoretical evaluations. It is noted that the agreement with theory is only qualitative; this is attributed to the inapplicability of the cascade theory to the extensive showers, in which other processes that the multiplication of electrons and photons take place, rather than to defects in the theory.

1902 Some Electronic Techniques for the Study of Cosmic Radiation (Su alcune tecniche elletroniche per lo studio della radiazione cosmica) by I F Quercia and B Rispoli Nuovo Cimento 6 63-78 (1949) Jan 20 (In Italian)

Some electronic techniques used in cosmic ray research are described. A synchroscope analysis of the wave-form of Geiger-Müller counter pulses was made and the photographs shown indicate that the various counter types differ as to pulse-rising time. Only the small and wholly metallic counters seem to be useful in high resolving-power coincidence circuits. Taking into account the pulse wave forms, the usual coincidence circuits have been modified to obtain one of high resolving power (less than 1 μsec). Diagrams are shown of a coincidence circuit having a resolving power of 0.5 μsec and of the mechanical recording circuit associated with it. These circuits were used in airplane flights and exhibited a high degree of stability.

The authors also describe a high-efficiency anticoincidence circuit which used the same input stages and can be used, in addition, to record delayed coincidences. Some of the electronic techniques used in recording delayed coincidences are discussed briefly and a new method employing a cathode ray tube with a synchroscope device sweep is suggested. All of the circuits described have been used by the authors in cosmic ray investigations.

1903 Energies of Heavy Nuclei in Cosmic Rays by Phyllis Freire, Edward P Ney and Frank Oppenheimer Phys Rev 75 991-992 (1949) Mar 15 (Letter to the editor)

Previously reported data [Bradt and Peters, Phys Rev 74 1818 (1948); Freier, Lofgren, Oppenheimer and Ney, Phys Rev 74 1818 (1948)] are summarized in tabular form and discussed by the authors The data give the electric charge, entrance velocity, and energy per nucleon at the top of the atmosphere, for 15 heavy cosmic-ray particles. The energy per nucleon has been calculated by taking into account the observed angle in the photographic emulsions and the altitude at which the observation was made. From these data it is concluded that a minimum energy of 0.5 Bev/nucleon is necessary for entry into the earth's magnetic field at a latitude less than 57°N magnetic latitude. The results suggest that the sun's magnetic field does not produce an energy cut-off noticeable at latitudes less than 51° and probably is not cutting off any particles even at the flight latitude of 55°. Indirect evidence which substantiates this conclusion is cited. It is expected that flights at more southerly latitudes which are being planned will provide useful information in general, and in particular will exclude the possibility that some of the observed nuclei only partially stripped of orbital electrons penetrate the magnetic field.

1904 The Energy Spectrum of the Photon Component of Cosmic Radiation by J Clay Physica 14 596-574 (1949) Jan

Using a coincidence counter arrangement suggested by previous experiments [Clay and Levert, Physical 12 321 (1946)] it was possible to obtain data on the number of photons which produced Compton electrons in a layer of 0.8 cm of Pb as compared wtih the number of photons which produced electron pairs. It is assumed that the photons have an E^{-S} spectrum (like the electrons) and the values of S are calculated for values above the critical energy "p". The values obtained are: $S_E<p = 1.25$ and $S_E>p = 1.07$.

COSMIC RADIATION AND MESONS (continued)

1905 The Intensity of Heavily Ionizing Penetrating Particles at 4300-Meter Altitude by Frank L Hereford Phys Rev 75 923-928 (1949) Mar 15

The counting efficiency of a low pressure Geiger-Mueller counter for the ionizing cosmic radiation penetrating various thicknesses of lead has been measured at an altitude of 4300 meters. From existing data it is possible to determine the counting efficiency expected for mesons alone at that altitude. For thicknesses greater than 100 g/cm^2 electrons are excluded, and the observed excess in counting efficiency over that expected for mesons can be interpreted as due to heavily ionizing particles. On the assumption that these are protons the data indicate, for example, that 17 $\pm$ 5% of the radiation penetrating 167 g/cm^2 Pb consists of protons. 7 figures 14 references.

1906 Local Production of the Penetrating Particles in Extensive Showers by G Salvini and G Tagliaferri Phys Rev 75 1112 (1949) Apr 1 (Letter to the editor)

The discrepancy between the results obtained by the authors and those of other investigators as to whether associations occur in the side distribution of the penetrating particles of extensive showers as reported by the authors[Phys Rev 73 261 (1948)] is discussed. The data referred to led to the conclusion that the penetrating particles are partly produced in the absorbers. It is noted that in the cases where the aforementioned results were obtained, the geometry used gave a higher probability of detection of extensive showers of low mean density; whereas, the converse was true of the experimental results in disagreement with the previously mentioned findings. Since the associations occur essentially in showers of low avergae density, this may account for the conflicting results obtained by Coccioni, Greisen and Treat[Phys Rev 74 62 (1948); 74 414 (1948)] and the verifying results of Broadbent and Jànossy[Proc Roy Soc A192 364 (1948)].

1907 Origin of the Radio Frequency Emission and Cosmic Radiation in the Milky Way by A Unsöld Nature 163 489-491 (1949) Mar 26 (Letter to the editor)

Recent measurements are discussed concerning galactic radio-frequency radiation which suggest a revision of current ideas on the origin of this radiation. The central hypothesis advanced is that the radio-frequency radiation of the galaxy as well as the cosmic radiation originate in late-type stars showing eruption-activity like the sun on a scale which is 10^{11} as great. Calculations and data supporting such a hypothesis are noted. The author suggests the importance of considering the large scale magnetic fields changing in vast layers of tenuous gas in developing a picture of the physical mechanisms for the production of both types of radiation. It is noted that changing solar magnetic fields can at most produce energies up to 10^9-10^{10} eV. The observation of energies up to 10^{15} eV appears to indicate the presence of much larger spots in stars, in agreement with the hypothesis advanced.

1908 Penetrating Particles in Extensive Cosmic-Ray Air Showers by G Cocconi, V Cocconi-Tongiorgi and K Greisen Phys Rev 75 1063-1071 (1949) Apr 1

The number of penetrating particles in extensive air showers has been determined as a function of the range of the particles and the size of the showers at a 3260-m elevation. A measuerment with the same apparatus has been made at a 260-m elevation, in order to show the altitude variation. It is found that the showers at 3260 m contain many photons and electrons which can be detected under absorbers of up to 7-inches of lead. The particles penetrating more than this thickness have a very small absorption coefficient in iron, and decrease in density slowly as they traverse the atmosphere. Hence they are thought to be primarily μ-mesons.

COSMIC RADIATION AND MESONS (continued)

1909 Penetrating Showers in Lead by W B Fretter Amer J Phys 17 148-153 (1949) Mar

Some previous investigations of penetrating showers using coincidence counters and cloud chambers are treated briefly. The advantages of using multiplate cloud chambers are discussed and 4 photographs obtained in this manner which have provided data on penetrating showers are shown. The lead plate photographs, which are discussed in some detail, illustrate the occurrence of the following phenomena; 1) local penetrating shower with successive production of penetrating particles, 2) a penetrating particle in an air shower with production of a penetrating shower containing high energy electrons, 3) a penetrating particle with production of a penetrating shower containing no high energy electrons, and 4) a very high energy penetrating shower with production of high energy penetrating particles, a large electron shower and a large nuclear explosion. The pictures clearly show the following: 1) simultaneous multiple production of penetrating particles, some of which can be identified as mesons, 2) successive multiple production of penetrating particles, and 3) simultaneous production of penetrating particles and electronic radiation. Some topics for further investigation are noted.

1910 Range of Cascade Showers in Lead by K Greisen Phys Rev 75 1071-1074 (1949) Apr 1

A calculation has been made of the probability of a cascade particle being detected under large thicknesses of lead, taking into account the effect of the low energy photons produced in the lead. The low energy photons greatly increase the probability of detection, and make the concept of "range" of a cascade shower in lead very indeterminate. The results have been applied to the case of large air showers, where general agreement is found between the calculated and experimental counting rates under large thicknesses.

1911 Relationships between the Generation of Heavy Particles, the Absorption of the Generating Component, and the Material at 3860 m Altitude (Zavisimost' obrazovaniya tyazhelykh chastits i pogloshcheniya generiruyushcheĭ ikh komponenty ot materiala na vysote 3860 metrov) by G E Belovitskii and L V Sukhov Doklady Adad Nauk SSSR 62 757-759 (1948) Oct 21 (In Russian)

At 3860 m, using the method of photographic emulsions, the determination was made of 1) the depencence of the number of heavy particles on the material in contact with the emulsion, and 2) the absorption of the generating component in lead, aluminum, and SiO_2. The experiments on the first problem were made with ordinary plates, ie., with emulsion on 0.1 cm glass, and with plates covered with 0.035 cm Pb. The results showed that only for tracks shorter than 10 cm air equivalent, the number of tracks generated in lead was 3-4 times larger than that of tracks generated in glass; for longer tracks both numbers were essentially equal. The results of the study of the second problem are presented in an absorption curve of the generating component in lead. It differs from the curve obtained by Heitler [Phys Rev 54 873 (1938)] in that it has no maximum (Heitler's curve has a maximum at 1.2 cm Pb). Its shape suggests that, at 3860 m, the generating radiation consists of two components: one, absorbed by 1-2 cm Pb, with an effective cross section about 8×10^{-24} cm^2; and another, very much harder, whose effective cross section is 6×10^{-25} cm^2. For Al the corresponding value is probably 0.9×10^{-25} cm^2, and for air 1.4×10^{-25} cm^2 (found by the authors, Doklady Akad Nauk SSSR 62 207-210 (1948). These numbers point to a possibility of disintegration of the component generating the heavy particles.

1912 Showers Generated in Lead by Mesons by P Bassi and A Loria Nature 163 400-401 (1949) Mar 12 (Letter to the editor)

During a systematic study of the showers produced by mesons, which was made using a threefold coincidence arrangement to trigger further counters, a method was used which gives the correction term for the transition effect directly by using data obtained for different counter arrangements. The apparatus diagrams and data obtained are given and it is noted that saturation was reached at about 1 cm of lead. This is in agreement with earlier results [Stuhlinger, Z Physik 116 281 (1940); Nassar and Hazen, Phys Rev 69 298 (1946)]. The corrected number of showers is about 1% of the number o mesons concerned.

COSMIC RADIATION AND MESONS (continued)

1913 Some Properties of the Cosmic-Ray Ionizing Particles That Generate Penetrating Showers by G Cocconi Phys Rev 75 1074-1078 (1949) April 1

The mean free path of the ionizing particles that produce penetrating showers has been measured in various materials at 260 and 3260 m above sea level. It has been found that in both places the mean free path is much larger in Pb than in C, and that it increases with the thickness of the absorbers. Possible interpretations of the results obtained are discussed.

1914 A Study of Cosmic Ray Showers Associated with Penetrating Particles (Izuchenie livnei kosmicheskikh luchei, soprovozhdayushchikh pronikayushchie chastitsy) by K I Alekseeva and S N Vernov Doklady Akad Nauk SSSR 62 199-202 (1948) Sept 11 (In Russian)

Showers produced in lead by particles passing through 4 cm of lead in the stratosphere were studied by means of balloons carrying a telescope (of 3 counters which alternated with 2 lead filters) and two lateral groups of 4 counters each. The curve giving the number of penetrating particles at different altitudes confirms the findings of Vernov et al. [Doklady Akad Nauk SSSR 57 No. 2 (1947)]. Another curve shows the ratio of the number of showers to the number of penetrating particles as a function of altitude; after a rise it becomes almost horizontal when the altitude exceeds 15 km. The authors conclude that the showers are produced mainly by primary protons whose average range in air is about 100 gr/cm^2.

1915 Threshold Energy for Meson Production by Walter H Barkas Phys Rev 75 1109-1110 (1949) Apr 1 (Letter to the editor)

The threshold energy for the production of mesons by colliding systems of elementary particles can be calculated by a simple relativistic extension of the principles employed in deducing the "Q" and the threshold beam energy for ordinary nuclear reactions. Only a knowledge of the mass energies is necessary in order to use this method to set a rigorous lower limit on the beam energy for single or multiple production of mesons. An expression for the kinetic energy of the beam in the laboratory system, T_i', at which the i-th resonance occurs is given and the absolute thresholds of a number of typical reactions leading to single meson production are given in tabular form. (A meson mass of 286 electron masses was used). The discrepancy between the results thus obtained and those of McMillan and Teller is noted and discussed.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

1916 Crystalline Stark Splitting and Microwave Resonance Absorption in Paramagnetic Salts by C Kittel and J M Luttinger. MIT Research Laboratory of Electronics Technical Report No. 49 Sept 10 1947 35p (NP-142)

A theoretical discussion is given of the application of microwave absorption measurements to the determination of energy levels in single crystals of paramagnetic salts. Selection rules are given for magnetic dipole transitions between sublevels in the presence of crystalline electric fields of cubic, tetragonal, trigonal and rhombic symmetry. The Zeeman effect in the presence of crystalline electric fields is discussed in some detail for three special cases: (a) $J = 5/2$, cubic field; (b) $J = 7/2$, cubic field; and (c) $J = 2/2$, trigonal field. These examples may correspond to certain magnetically dilute salts containing Fe^{+++}, Gd^{+++} and Cr^{+++} ions, respectively, provided that exchange interactions do not play an important role. Numerical values are tabulated for the relative frequencies and line strengths associated with magnetic dipole transitions in the cases discussed. The character of the spectra may change radically between the limit where the Zeeman splitting is small in comparison with the Stark splitting, and the opposite limit where the Stark splitting may be neglected.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE (continued)

1917 Electronic Eigenfunctions in Ionic Crystals by Reikichi Nosawa Phys Rev 75 1102-1103 (1949) Apr 1 (Letter to the editor)

The Wigner-Seitz approximation method, which has been applied to the problem of valence-electrons in metals, has been improved and extended by using and generalizing Von der Lage and Bethe's "Kubic Harmonics" [Phys Rev 71 612 (1947)]. The present method differs from previous methods in the following ways: 1) The electron-potentials have been assumed to have the crystal symmetry within a lattice cell. 2) Boundary conditions have been satisifed more exactly than in their treatment by using a different average fitting and, in consequence, the arbitrariness in choosing the fitting points on the cell surface is removed. 3) The electron potential adopted is naturally continuous throughout the crystal except at the lattice points and has the full cubic symmetry. 4) Reasonable joining of the wave functions at the cell boundaries has been achieved in virtue of this potential. This method is being applied to NaCl and CsCl to determine the ground state of the valence electron in both crystals and the results will be published shortly.

FLUORINE AND FLUOROCARBONS

1918 Physical Properties of Some Fluorocarbons and Related Compounds by J L Gabbard, J D Gibson, E S Amis, R Alvarez, V E Anderson, S Blumkin, C W Cunningham, J F Dietrich, J W Grisard, J R Hendrickson, W W Lemarr, N C Orrick, C W Rhoades and F V Williams. AECU-186 (K-371) Mar 31 1949 36p

The density, viscosity, surface tension, vapor pressure and refractive index of a number of fluorocarbons and related compounds have been measured as a function of temperature, and equations relating each of these properties to temperature have been derived. The molecular weight and freezing point of these compounds were also determined. The fluorocarbons studied were: undecafluoro(trifluoromethyl) cyclohexane, $C_6F_{11}CF_3$; hexadecafluoroheptane, C_7F_{16}; decafluorobis(trifluoromethyl) cyclohexane, $C_6F_{10}(CF_3)_2$; chlorononafluorobis(trifluoromethyl)cyclohexane, $C_6F_9Cl(CF_3)_2$; and bis (trifluoromethyl)benzene, $C_6H_4(CF_3)_2$. The molar parachors, molar surface energies, molar refractions, boiling points, entropies, and heats of vaporization were calculated from the experimental data. Data on the same physical properties of technical grade sample of these materials are also presented for the sake of comparison.

1919 Microwave Investigations of Methyl Fluoride, Fluoroform, and Phosphorus Trifluoride by O R Gilliam, H D Edwards and Walter Gordy Phys Rev 75 1014-1016 (1949) Apr 1

From measurements on pure rotational transitions in the microwave region the moments of inertia, I_B in g cm^2 X 10^{-40}, have been determined as follows: 32.8544 for $C^{12}H_3F$, 33.7444 for $C^{13}H_3F$, 81.0693 for $C^{12}HF_3$, and 107.286 for $P^{31}F_3$. The molecular dimensions determined are: for CH_3F, d_{CH} = 1.109A, d_{CF} = 1.385A, and $\angle$HCH = 110°O′; for CHF_3, d_{CF} = 1.326A, with d_{CH} = 1.111A (assumed) and $\angle$FCF = 110° (assumed); for PF_3, d_{PF} = 1.546±0.008A with $\angle$FPF = 104±3° (assumed). The line breadth parameters, $\Delta\nu$, normalized to 1 mm of Hg pressure are 20 mc for CH_3F, 18 mc for CHF_3, and 16 mc for PF_3. Confirming evidence for the nuclear spin values, 1/2 for P^{31} and F^{19} has also been obtained.

GEOLOGY AND GEOPHYSICS

1920 Radioactivity of Ocean Sediments. VI. Concentrations of the Radioelements in Marine Sediments of the Southern Hemisphere by William D Urry Amer J Sci 247 257-275 (1949) Apr

In the previous publications of this series[Amer J Sci 25 229 (1933); J Wash Acad Sci 29 405 (1939); Amer J Sci 239 81 (1941); 240 1 (1942); 240 93 (1942)] the use of measurements of the radium concentration in the sediments beneath the ocean as a means of determining the age of the sediments has been described. Since the previous data were taken in the northern hemisphere, further determinations have been made using cores obtained from the southern hemisphere. Seventy such determinations of the radium content of ocean sediments have been made for a number of depths in each of six cores obtained from various areas. The curves thus obtained of the radium content as a function of depth

GEOLOGY AND GEOPHYSICS (continued)

below the ocean bottom are similar in all qualitative respects to the curves previously obtained for cores from the North Atlantic and Caribbean Sea.

GRAPHITE

1921 The Graphitation (La graphitation) by H Brusset Bull Soc Chim France 1949 D 49-D 52 (1949) Jan-Feb (In French)

Various aspects of the transformation of amorphous carbon into graphite were studied experimentally. The process does not seem to be a purely solid-phase reaction, at least not in cases when certain catalytic agents are used. The reaction proceeds in two stages, of which the second one, taking place at high temperatures, is the graphitation proper.

HEALTH PROTECTION

1922 Stack Meteorology and Atmospheric Disposal of Radioactive Waste by Norman R Beers Nucleonics 4 No. 4, 28-38 (1949) Apr

Stack meteorology and the atmospheric disposal of radioactive waste are discussed with particular reference to the meteorology towers being used in this connection at the Brookhaven National Laboratory. Some of the more important parameters with which the stack meteorologist determines the control regime to be adopted for a particular waste disposal installation are treated and Sutton's expression [Quart J Roy Met Soc 73 426 (1947)] for the concentration of pollutant downwind from a continuously emitting point source is discussed. Some oil-fog smoke tests which have been made to provide necessary information are described and some of the problems of meteorological control are noted.

INSTRUMENTS

1923 A Remotely-Controlled Glass Apparatus for Dissolving U Metal by L S Goldring, E L Brady and H A Levy. AECD-2562 (ANL-NS-212) nd Decl Apr 18 1949 13p For publication in NNES

A glass apparatus is described which is designed to dissolve U slugs from the Clinton pile to yield a 65 per cent solution of UNH (uranyl nitrate hexahydrate) and to transfer portions of this solution to any of several neighboring points for subsequent use. All parts coming in contact with solution are of glass or platinum in order to reduce to a minimum impurities in the product solution. Shielding is sufficient to provide safe working conditions while dissolving one or two slugs of the maximum activity obtainable in the Clinton pile.

1924 A Transient Analysis of the Cathode-Coupled Feedback Loop by Dean A Watkins. AECU-184 (LAMS-834) Mar 3 1949 30p

The wide-band, three-tube, cathode-coupled feedback loop is analyzed from the transient viewpoint using the method of the Laplace transform. The results of the analysis are given by four simple equations useful in the design of the loop. A typical design using WE404A tubes is given, together with experimental results.

1925 Pulse Generator by Philip E Ohmart and Dwight McKee. AECU-185 (MLM-302) Mar 28 1949 4p

The pulse generator, shown with an accompanying circuit diagram, has been found to be useful when checking nuclear counters for such faults as trigger circuits multi-pulsing and scaling circuits "scaling through."

INSTRUMENTS (continued)

1926 Some Notes on Wideband Feedback Amplifiers by Val Fitch. AECU-194 (LAMS-862; LADC-661) Mar 16 1949 29p

This paper considers feedback amplifiers from the standpoint of high-frequency performance. The circuit conditions for optimum steady-state (sinusoidal) and transient response are derived and practical circuits (both interstage and output) are presented which fulfill these conditions. In general, the results obtained may be applied to the low-frequency end.

1927 Analysis of a Half-Wave Rectifier Circuit Involving Inductance, Resistance, and Capacity by F E Bothwell and P D Crout. MIT Radiation Laboratory Report RL-867 Dec 26 1945 41p

A description of an approximate solution of the half-wave rectifier circuit problem discussed in Radiation Laboratory Report T-12 is given. Design curves for choosing optimum values of rectifier constants are given. The exact solution is involved, inasmuch as it contains the circuit constants in complicated expressions; the approximate analysis presented contains the circuit constants in a more simplified form.

1928 The Application of Powdered Iron Materials as Permeable Dielectrics at Microwave Frequencies by Maurice B Hall and Margaret Harwood. MIT Radiation Laboratory Report RL-906 Mar 26 1946 24p

During the war, powdered iron transformer-core materials have been applied at microwave frequencies as permeable dielectrics. Measurements on several samples of the material have yielded high values for the magnetic hysteresis and values of 6 and higher for the ratio K/μ, the real parts of the dielectric constant and the permeability, respectively; consequently these materials give much higher attenuation than ordinary dielectrics having the same conductivity. Attenuations have been estimated of nearly 100 db per inch at 10 cm, nearly 300 db per inch at 3.2 cm, and well over 300 db per inch at 1.25 cm. Since the attenuation of these materials results mainly from hysteresis, the materials dissipate heavily in regions of high magnetic intensity, even if the electric intensity is low when standing waves are present. The value of $\frac{j\omega\mu+\mu'}{j\omega\mu+K'}$ measured for the iron core materials, is of the order of that for air, so that reflections from an air-iron-core interface are lower than from a boundary between air and other available materials of comparable attenuation. These and some other useful properties and applications of iron core materials at microwave frequencies are discussed.

1929 Beacon Discrimination Circuit by J H Buck. MIT Radiation Laboratory Report RL-29 Nov 15 1941 14p

The description and operation of a circuit to discriminate between $\frac{1}{2}$ micro-second and 1 micro-second pulses, such that the $\frac{1}{2}$ micro-second pulses are passed but the 1 micro-second pulses are blocked, is given. The operation is based upon a triple "coincidence circuit" by a square pulse. Circuit diagrams and graphic presentations of oscilloscope traces are shown.

1930 Discontinuities in Standing Wave Detectors and Waveguide Junction Steps by Ina G Mansur. MIT Radiation Laboratory Report RL-893 Dec 14 1945 15p

The report is divided into two parts, (1) discontinuities in standing wave detectors, and (2) discontinuities caused by waveguide junction steps. An improvement in the accuracy of measurements taken with a standing wave detector can be achieved by: decreasing the slot width or tapering the slot at both ends for a length of $\lambda g/2$ at mid-band, tapering the metal strip guiding the probe carriage along the slot in both length and thickness for a length of $\lambda g/2$, and improving the choke-flange couplings. Theory is given for discontinuities in wave guide junction steps. A step in 1/2" x 1"guide of .020" (inside) in either dimension or both dimensions in the same direction introduces a mismatch of about 1.05 in voltage standing wave ratios. If 1/2" x 1" wave guide with corners rounded by 1/8" radius is connected to standard guide, the v.s.w.r. at 3.3 cm is 1.05.

INSTRUMENTS (continued)

1931 E_0 Rotary Joints for the 3 Centimeter Band by F Edward Ehlers. MIT Radiation Laboratory Report RL-853 Dec 4 1945 34p

This report discusses in detail two types of E_0 transitions for use in rotary joints. One of these uses a resonant ring filter to supress the $H_{1,1}$ mode and excites less than 1/2% of the energy in this mode over the band from 3.13 to 3.53 cm wavelength. The standing-wave ratio of this transition is 1.1 or less over this band. Due to the possibility of $H_{1,1}$ mode resonances, two such transitions spaced 3.780" between bottoms of the rectangular waveguide will operate satisfactorily only in the band from 3.13 to 3.37 cm. A design of an $H_{1,1}$ mode absorber to eliminate resonances makes it possible to use a round waveguide section of any length to cover the complete band from 3.13 to 3.53 cm. The second type of transition requires no resonant ring or mode suppressing device and is usable over a band from 3.13 to 3.33 cm. One feature of this transition is that it has rounded edges and is capable of transmitting very high power. Charts of resonant wavelength versus spacing of the two transitions are included for both types of transitions so that proper lengths may be selected in order to avoid resonances.

1932 Electrometer Tubes for the Measurement of Small Currents by John A Victoreen Proc Inst Radio Engrs 37 432-441 (1949) Apr

The necessary differences between ordinary electron tubes and electrometer tubes which are used to measure small currents of the order of 10^{-12} ampere are discussed from a practical viewpoint. The problems incurred by the low plate currents and voltages involved in such tubes are noted and some of the low grid current and high leakage-resistance techniques are presented. Characteristics of such tubes are given in terms which are generally applicable.

1933 Flexible Waveguides by Francis T Worrell. MIT Radiation Laboratory Report RL-832 Oct 19 1945 19p

The various types of service for which flexible waveguides are required are listed. Available information on the various types of flexible waveguide is presented in detail. References are made to more detailed reports. The types of waveguide discussed are: wound metal hose, Titeflex, seamless corrugated waveguide, vertebrae, and bellows. Recommendations are made as to which types of waveguide are suitable for the various types of service.

1934 High Voltage Oxide Coated Vacuum Rectifiers by K J Germeshausin and K J Urguhart. MIT Radiation Laboratory Report RL-892 Dec 19 1945 18p

Conventional diode rating methods are discussed and a new rating method based on anode dissipation is proposed. Diode design considerations are surveyed and applied to the development of an oxide coated cathode diode rated at 20 KV inverse and 100 milliamperes average. Life test data on the Raytheon QK95 are also included.

1935 Input Impedance and Tuning of Magnetron Cavities by J C Slater. MIT Radiation Laboratory Report RL-190 Feb 3 1943 41p

Measurements of the cold impedance of magnetron cavities looking in through either the output lead or a tuning lead, together with their theoretical interpretation, are presented. The measurements are made by attaching a coaxial tuner to the output lead, and observing the resonant wave lengths of the combined systems as a function of slider position. The theory is worked out, following the lines of general theory of cavity oscillations presented in Report 43-16. Agreement between observations and theory is excellent. The coefficients in the function giving input impedance as a function of wave length have values which can be derived with satisfactory accuracy from theory, and from the size of the coupling loop. These coefficients, and the type of data presented in this report, are valuable in such problems as frequency pulling, and magnetron tuning. The measurements are largely of the reactive component of impedance, but there is a brief discussion of the resistive component and Q values.

INSTRUMENTS (continued)

1936 Measurements with a Frequency-Modulated Oscillator at 3 CM by C G Montgomery and D D Montgomery. MIT Radiation Laboratory Report RL-167 Jan 18 1943 12p

A method is presented of making certain measurements using a frequency-modulated generator and an oscilloscope in such a way that the response of the object under test to a band of frequencies is visible simultaneously. By a transmission method the resonant frequency of a cavity, the loaded Q, and the transmission can be determined. The relation between these quantities and the unloaded Q has been verified. By a reaction type measurement, the conductance and loaded Q of a cavity can be determined. A knowledge of the conductance enables the cavity losses to be measured. Increases in the losses of a cavity with humidity and with time are reported. If the losses are known, the susceptance of the coupling window is found. This susceptance has been measured for round holes in rectangular wave guides and compared with results obtained by transmission measurements and with a theoretical result.

1937 Measuring Instruments for Three Centimeters. MIT Radiation Laboratory Report RL-26 Mar 9 1942 18p

A number of instruments are described for measurements at a wavelength of three centimeters, developed in the high frequency group of the Radiation Laboratory. These include a bolometer power meter, a preamplifier for the bolometer, an I. F. amplifier and noise meter, a three centimeter pulse generator, an attenuator, a lock-in amplifier and two bolometer probes for measuring field intensity in wave guides and in space.

1938 A Microwave Band-Pass Filter in Waveguide by H A Leiter. MIT Radiation Laboratory Report RL-812 Nov 16 1945 31p

General design principles of band-pass filters of the multi-tuned circuit type are applied to the development of a filter for use in the microwave region. The development, construction, characteristics, and method of tune-up for a filter having a pass band of 50 mc centered at 2880 mc an insertion loss of less than .5 db at the center of the band, and a variation of less than 1 db over the band are described.

1939 Polarization Effects in a Circular Wave Guide at 3 Cm by D D Montgomery and C G Montgomery. MIT Radiation Laboratory Report RL-162 Sept 12 1942 9p

A discontinuity in a round wave-guide can convert energy from one state of polarization to another. Two ways of compensating for this, when it is desirable to maintain polarization are discussed (1) deformation of the round guide to make it elliptical in the proper plane by the proper amount and (2) the introduction of a thin slab of dielectric material of the correct length. These methods may be used, for example, to compensate for the effects of a bad bend. Either method may be employed to produce quarter-wave or half-wave plates. Two quarter-wave plates and a half-wave plate may be used as a very satisfactory phase-shifter. An idealized radar system employing circularly polarized radiation and a common transmitting and receiving antenna, but no TR box, is described.

1940 Propagation in Wave Guides Partly Filled with a Dielectric by N H Frank. MIT Radiation Laboratory Report RL-174 Apr 27 1942 8p

The problem of the propagation of the lowest H-wave in a rectangular wave guide partially filled with a dielectric is solved. The dielectric-air interface is parallel to the lines of the electric field, the opposite face being in contact with one of the guide walls. Curves are given showing the variation of the wavelength in the guide as a function of frequency for various thicknesses of dielectric and as a function of dielectric thickness for various frequencies. The cut-off wavelength both for the lowest and next lowest modes are shown as functions of the fraction of the guide filled with dielectric. Plots of the field distributions are given for three typical cases: (a) when the guide wavelength is less than the free space wavelength; (b) when the guide wavelength equals the free space wavelength; and (c) when the guide wavelength is greater than the free space wavelength.

INSTRUMENTS (continued)

1941 The Proton Microscope by Claude Magnan Nucleonics 4 No. 4, 52-66 (1949) Apr

The limitations of microscopes using light and the advantages of those which utilize electrons, whose de Broglie wave lengths can be made shorter than that of visible light, are discussed. Since a further reduction in the wave length used may be achieved with heavier particles such as the proton, the principles of the electron microscope have been extended to the design of a proton microscope which has been built at the Collège de France and is theoretically capable of producing a magnification of 600,000X. The calculations for the various abberations have been made using the equations of motion for charged particles in the electromagnetic field and a diagram showing the construction of the proton microscope is given. The resolving power and optimum aperture for various illuminating particles are given in tabular form and it is noted that a microscope utilizing xenon as the illuminating particle would have a resolving power of 0.24×10^{-8} cm which is close to the diameter of the most external shells of the atom. From the Heisenberg principle it has been concluded that it is impossible to see the internal structure of atoms with corpuscular microscopes. However, the proton microscope, and microscopes using heavier ions, will permit the observation of objects having sized compatible with a resolving power of 1.5×10^{-8} cm and less. Such microscopes will require new types of ion sources and extremely thin samples.

1942 Pulse-Forming Network Committee (Proposed) Basic Specification for Pulse - Forming Networks by P R Gillette. MIT Radiation Laboratory Report RL-883 Nov 2 1945 28p

The body of this report is the second draft of a basic specification for pulse-forming networks designed for use in high-power network-type pulse generators. The specification is similar in form and general content to Joint Army-Navy specifications for capacitors and similar equipment. It covers only general requirements for networks which generate approximately rectangular pulses by condenser discharge, and are contained in hermetically sealed metallic cases. It contains requirements for general construction, insulation and resistance to service conditions, and recommended tests of these characteristics. Brief descriptions of a few of the various electrical types of networks which have been developed are given in an appendix. A second appendix is devoted to a consideration of the problem of definition of the amplitude and duration of pulses which are not perfectly rectangular. Details of pulse test methods which have been developed by the Radiation Laboratory are included in other appendexes.

1943 Radiation Resistance of Antennas Inside Wave Guides of Arbitrary Cross-Sections by J L Chu. MIT Radiation Laboratory Report RL-177 July 3 1942 5p

The radiation resistance of an antenna inside a wave guide is given for a few simple geometrical configurations. Knowledge of this resistance is useful in the coupling of a coaxial line to a wave guide. The method by which the results in this report have been obtained is applicable to wave guides of arbitrary cross-sections.

1944 Rat Race Duplexing by John Reed King. MIT Radiation Laboratory Report RL-885 Feb 4 1946 18p

A method of duplexing using two magic tees and two TR boxes is discussed. This scheme does not require an ATR box. The rat race form of the magic tee is used because of its greater power-handling ability and bandwidth. The high level voltage standing wave ratio is less than 1.13 over the 12 per cent range at X band. The low level loss is less than 1.0 db including TR and ATR loss for all magnetron impedances. S band versions are also described.

INSTRUMENTS (continued)

1945 Reflections from Sections of Tapered Transmission Lines and Wave Guides by N H Frank. MIT Radiation Laboratory Report RL-189 Jan 6 1943 14p

Sections of tapered transmission lines are useful as matching devices over wide frequency ranges if the fractional changes of the line parameters per wave length are small compared to unity. For such a line, approximate solutions give traveling waves of slowly varying amplitude and wave length and to this approximation the theory predicts no reflection from a junction between a uniform and tapered line if the characteristic impedances of each are equal at the junction. In this report, a second approximation is obtained to this solution and explicit formulas are obtained for the reflection from the type of junction described above when the tapered line is terminated in an arbitrary impedance. The general theory of the integration of the Maxwell equations for propagation in a medium whose properties vary in one dimension is developed and applied to the case of "tapered" wave guides, i.e., wave guides filled with a medium whose properties vary along the length of the guide. Approximate solutions for slowly varying parameters of the sort mentioned above are derived and reflection coefficients computed for TE waves. The results are stricIty analogous to those obtained for the tapered line.

1946 Special Report on Cathode Temperatures in Magnetrons by C S Robinson Jr. MIT Radiation Laboratory Report RL-90 Mar 31 1942 14p

The cathode temperature in several types of magnetrons has been studied over a wide range of operating conditions. Strapped magnetrons show the anomalous effect that, as the power output is increased, with constant current, the cathode temperature passes through a maximum. The results are discussed with a view to increasing magnetron life, and operating at high levels of power output. The data on the fraction of the input power returned to the cathode may be useful in connection with the theory of the magnetron. Results of life-tests at high power are given.

1947 Special Report on a 30 MC Pulsed Signal Generator by R F Bacher and Philip C Michel. MIT Radiation Laboratory Report RL-109 Oct 16 1941 10p

This report describes a pulsed 30 MC signal generator to be used for testing amplifiers of R.D.F. systems.

1948 Special Report on Tunable Cavities. MIT Radiation Laboratory Report RL-143 Oct 18 1941 4p

A tunable concentric line cavity in which the sliding element touches neither the inner nor the outer conductor and which is used with retarded field tubes to obtain different D C voltages on the acceleartor grid and anode is described.

1949 Special Report on Wave Guide Termination for Measuring Power at 3.2 Cm. MIT Radiation Laboratory Report RL-89 Feb 24 1942 8p

A wave guide termination suitable for measuring power at 3.2 cm is described. It consists of a water chamber at the end of a 3 cm wave guide. In front of the water is a quarter-wave section of mycalex. The mycalex behaves as a non-reflecting film and the water-mycalex combination serves as a black body for 3.2 cm radiation. Such a device requires no tuning and does not suffer breakdown. Power is measured by observing the temperature rise of water flowing through the chamber. A detailed drawing of the power absorber is given, and a description of its use. Measurements of standing wave ratio are given, and curves of the required thickness of mycalex for minimum standing wave ratio are presented.

INSTRUMENTS (continued)

1950 Theory of High Frequency Rectification by Silicon Crystals by H A Bethe. MIT Radiation Laboratory Report RL-184 Oct 29 1942 13p

This paper deals only with those phenomena in high frequency rectification which are due to the combined effect of conductivity and capacity. The excellent performance of British crystals is explained as due to the knife edge contact against a polished surface. High frequency rectifications depends critically on the capacity of rectifying boundary layer of the crystal. For high conversion efficiency, the product of this capacity and of the "forward" (bulk) resistance of the crystal must be small. For a knife edge, this product depends primarily on the breadth of the knife edge and very little upon its length. The contact can therefore have a rather large area which prevents burn-out. For a wavelength of 10 cm the computations show that the breadth of the knife edge should be less than about 10^{-3} cm. For a point contact the radius must be less than 1.5×10^{-3} cm and the resulting small area is conducive to burn-out. The effect of "tapping" is probably to reduce the area of contact.

1951 A 3 Cm Magnetron Cold Impedance by D D Montgomery and C G Montgomery. MIT Radiation Laboratory Report RL-163 Sept 16 1942 5p

Tests on eight "standard" 3 cm magnetrons showed that it is impossible, with the present design, to fix the distance from the magnetron output to the T-section. Further, it is indicated that if this distance is chosen to be best for each magnetron, too much of the received signal is absorbed in the magnetron.

1952 3-Cm Vertebrae Flexible Waveguide by F T Worrell. MIT Radiation Laboratory Report RL-831 Oct 10 1945 19p

The general theory of operation and the construction of 3-cm vertebrae are discussed. Data are given on the standing wave ratio and loss introduced by the vertebrae for various distortions, and the power handling capacity. Information is given on their general usefulness and limitations.

1953 Various 3 Cm TR Box Characteristics by N C Colby and C W Zabel. MIT Radiation Laboratory Report RL-166 Jan 6 1943 19p

Part I: The better 3 cm TR boxes available, at the time the measurements were made, transmitted from 25 to 45 milliwatts peak over a range at from 2 to 15 kilowatts peak incident power. Part II: Constant power contours are plotted on an admittance circle diagram showing the relation between loan and transmitted power over a range of from 20 mw to 70 mw peak with a constant incident power of 13.5 kw peak. Part III: Measurements made on TR boxes, tuned for optimum performance in a system, indicated a complete recovery time of the order of 10 micro-seconds. Detuning in one direction lengthened the recovery time while detuning in the opposite direction shortened the recovery time.

ISOTOPES

1954 Some Possible Rare Isotopes by Henry E Duckworth. AECU-196 (WU-1) Mar 18 1949 7p

Empirical relationships between existent stable nuclei are presented, and the possible existence of unobserved rare stable isotopes (Te^{118}, Gd^{150} and Pt^{190}) is predicted.

1955 Isotopes Branch Bulletin No. III by G H Guest. National Research Council of Canada Report CR-IB-412 Feb 1949 12p

Information of interest to users of radioisotopes in Canada, including a report of a conference on industrial uses of radioisotopes held at Ottawa December 7, 1948, is presented. Information on the use of detection and counting instruments, Co^{60} as a high energy gamma-ray source for radiography, C^{14} in chemical and biochemical research, laboratory facilities and hazards, and tracer uses in the United States is reported. 20 references.

ISOTOPES (continued)

1956 On Certain Regularities in the Existence of Isotopes (O nekotorykh zakonomernostyakh v sushchestvovanii izotopov) by L A Mindalev Zhur Obshchei Khimii 18 32-39 (1948) Jan (In Russian)

Beginning with Z = 8, the lowest (and the highest) isotopes show an alternating increase and decrease of the numbers n/p and n-p, when Z increases, (n is the number of neutrons in the nucleus, p is the number of protons. For the lowest isotopes, n/p and n-p increase in the case of an odd Z; they decrease in the case of an even Z; (the opposite rule is true for the highest isotopes). The number of neutrons is always even in the lowest isotopes (the "neutron-pair rule"). For the lowest (and the highest) isotopes of elements with even Z, the numbers n-p lie on a straight line at 45° to the coordinate axes. An attempt is made to explain the existence of one-isotope elements. A tentative general formula is suggested giving the atomic weight of the lowest isotope for any Z. The question is discussed as to the probable end of the periodic table.

METALS AND METALLURGY

1957 Theoretical Study of the Diffusion Constant for Self-Diffusion in Metals by M Leichter. National Advisory Committee for Aeronautics Technical Note No. NACA-TN-1856 Apr 1949 14p

Phenomena such as age-hardening, annealing, and order-disorder transformation depend on the ability of atoms to migrate through an atomic lattice. It is therefore of importance to understand the factors that determine the rate at which such migration occurs. One method of determining the movements of atoms within a lattice is to study the rate at which metals diffuse into each other under controlled conditions. A special case of diffusion in metals is the case of self-diffusion. An expression for the diffusion constant for self-diffusion in metals is derived, based on the assumption that self-diffusion occurs by the vacancy mechanism. The factors determining A in the expression $D = Ae^{-Q/RT}$, where D is the diffusion constant, Q is the energy of activation, R is the gas constant, and T is the temperature, are found to be the characteristic frequency of vibration of the atoms, the crystal structure, the lattice constant, the heat of fusion, the temperature, and the activation energy for an atomic jump. A comparison of the calculated values of A with the limited experimental data available shows that the calculated values are of the correct order of magnitude.

1958 Titanium and Titanium-Base Alloys. Battelle Memorial Institute Report R-131 (Rand Corporation) Mar 15 1949 175p

This report presents an appraisal of the worth of titanium metal and titanium-base alloys as materials of construction and also the details of the research and evaluation program on which the appraisal is based. The following topics are discussed: reduction of metallic titanium, production of titanium in massive form, alloys of titanium, comparison of the properties of titanium and titanium-base alloys with other materials, and fabrication characteristics and analysis of titanium and titanium-based alloys. Appendixes include the details of reduction processes investigated at Battelle Memorial Institute, reduction of titanium compounds by gases, properties of titanium processed by the U. S. Bureau of Mines and P. R. Mallory and Company, arc melting of titanium and titanium-base alloys at Battelle, effects of oxygen, nitrogen, and hydrogen on iodide titanium, titanium-base alloys prepared by powder metallurgy methods, room temperature properties of arc-melted titanium and titanium-base alloys. 80 references.

MINERAL RESOURCES AND MINERALOGY

1959 Diffusion Coefficients of Lead in Some Radioactive Minerals (Diffusjonskoeffisienten for bly i noen radioaktive mineraler) by Ivan Th Rosenqvist, with a mathematical appendix by Jan Garwick Geologiska Föreningens I Stockholm Förhandlingar 71 57-70 (1949) Jan-Feb (In Norwegian)

By chemical analyses of some radioactive minerals of known age the diffusion coefficients of lead are calculated. In the mathematical appendix an equation is given for the diffusion coefficient of a stable element in a radioactive mineral. It is based on the following assumptions: 1) The activation

MINERAL RESOURCES AND MINERALOGY (continued)

energy of the element formed is less than the activation energy of the parent element. 2) The activity of the stable element formed is less on the surface of the mineral than in the central parts of the mineral. 3) The age of the mineral is known. Different reasons make assumptions 1 and 2 probable in most cases. It is further necessary to know the age, the dimensions, and the exact chemical composition of the mineral. The minerals investigated and the values of the diffusion coefficient are: 1) 4 samarskite-yttrotantalites from southern Norway $D_{Pb} = 4.10^{-19}$ cm^2/sec; 2) 5 uranothorites from southern Norway $D_{Pb} = 1.10^{-18}$ cm^2/sec; 3) 1 uraninite from southern Norway $D_{Pb} = 2.10^{-22}$ cm^2/sec; 4) 1 uraninite from Morogoro $D_{Pb} = 4.10^{-22}$ cm^2/sec. The diffusion coefficients found must be regarded as mean values for more than 1000 million years of the minerals' existence. As the thermodynamical conditions during this time are unknown, the temperature dependence of D has to be determined by other methods; this work is now being done in the author's laboratory. In another paper (Norske Geologisk Tidskrift in print) the author has discussed the possibilities of metasomatism caused by diffusion in solid state. It was established that the part played by this process is rather unimportant when the distances involved exceed a few centimeters, even if the length of the geological time is taken into account. In the paper mentioned, the diffusion coefficient was arbitrarily taken equal to 10^{-10}. This value is certainly too high, as is shown by the values of the diffusion coefficients of lead in the metamict-amorphous uranothorites and samarskites.

1960 Radioactive Properties of the Mittagfluh Granite (Radioaktivität und ihre Erscheinungen am Mittagfluhgranit) by H Hirschi Schweizerische Mineralogische und Petrographische Mitteilungen 28 509-517 (1948) (In German)

Accurate activity measurements on many rock samples (pieces, powders) from the peripheral zone of the Mittagfluh granite (Aaremassiv, Switzerland) showed that this formation was the most intensely radioactive of Swiss rocks investigated so far. It was observed that the ionization current produced by thick rock layers was many times stronger than that which could be expected from their radioactive-element content. The additional current is mainly due to secondary ions emitted from the outer parts of the formation. The existence of secondary radiations of a complex nature is thus established; their intensity is the greater, the larger the volume and the more complex the structure of the rock involved. Small samples of rocks and of individual minerals can only reveal comparatively low activities. The phenomenon studied is especially intense in acid igneous rocks; this is due to the presence of elements like Li, Be, B, known to emit nuclear radiations when acted upon by rays from strong radioactive sources. It is possible that the same phenomenon, especially through the agency of potassium bearing rocks, may determine a large scale radioactive discharge of cumulated radiation energy. It should therefore be studied in connection with certain problems of climatology and plant biology.

1961 A Trip into the Mining Union of High-Katanga (Visite à l'union minière du Haut-Katanga) by André Savornin Annales des Mines 137 No. 3, 3-21 (1948) (In French)

The author is a former director of mining research at the French Atomic Energy Commission. An account is here given of his trip in the large Belgian mining district of High-Katanga in the Belgian Congo. The geology of the region, the mining and industrial activities are described. One chapter contains information on the important uranium-bearing formations of Shinkolobwe and on the part American interests play in its exploitation.

NEUTRONS

1962 Papers for Plutonium Project Record Volume 9B Chap 7 and Chap 12 ed by N Sugarman. AECD-2567 nd Decl Apr 18 1949 19p For publication in NNES

The individual papers of this document are abstracted below.

NEUTRONS (continued)

1963 Thermal Neutron Absorption Cross Sections of Unstable Nuclei. I. Introductory Paper by Seymour Katcoff. AECD-2567-A nd Decl Apr 18 1949 5p

The activation method for determining thermal neutron cross sections of stable nuclei (Seren, Friedlander, and Turkel, CP-2376, Nov 21 1944) can be extended to finding those of radioactive ones in certain favorable cases. It is usually necessary in such experiments to irradiated samples in a neutron flux of about 10^{12} n/cm^2 sec.

1964 Thermal Neutron Absorption Cross Sections of Unstable Nuclei. II. 75m Kr^{87} by N Sugarman and A Turkevich. AECD-2567-B nd Decl Apr 18 1949 1p

An upper limit for the thermal neutron capture cross-section of 75m Kr^{87} was found to be 470 barns.

1965 Thermal Neutron Absorption Cross Sections of Unstable Nuclei. III. 17.5m Rb^{88} by Seymour Katcoff. AECD-2567-C nd Decl Apr 18 1949 1p

An upper limit for the thermal neutron capture cross section of 17.5m Rb^{88} was found to be 200 barns.

1966 Thermal Neutron Absorption Cross Sections of Unstable Nuclei. IV. 85m Ba^{139} by Seymour Katcoff. AECD-2567-D nd Decl Apr 18 1949 6p

The thermal neutron capture cross section for 85m Ba^{139} was found to be 3.8 ± 1 barns.

1967 Thermal Neutron Absorption Cross Sections of Unstable Nuclei. V. 55d Sr^{89} by Seymour Katcoff. AECD-2567-E nd Decl Apr 18 1949 6p

An upper limit for the thermal neutron capture cross section of 55d Sr^{89} was found to be 108 barns.

1968 Some Activities from Tritium Bombardment in Neutron-Irradiated Li Salts: The (t,n) Reaction on O and S by J D Knight, T B Novey, C V Cannon and A Turkevich. AECD-2567-F nd Decl Apr 18 1949 11p

The 112m F^{18} and 33m Cl^{34} have been produced and identified in neutron-irradiated Li salts containing O and S respectively. They are produced by bombardment of O^{16} and S^{32} by tritons coming from ${}_3Li^6(n,\alpha){}_1H^3$. A preliminary search for P^{33} by (t,p) on P^{31} has been unsuccessful.

1969 The Effect of Small Angle Scattering on Neutron Cross-Section Measurements by H H A Krueger, D Meneghetti, G R Ringo and L Winsberg Phys Rev 75 1098-1099 (1949) Apr 1 (Letter to the editor)

Data have been taken which indicate that the large scattering components observed in the region below 0.003 ev during neutron cross-section studies of powdered crystalline CaO and ZnO with the mechanical velocity selector [Phys Rev 75 975 (1949)] are due to the scattering of neutrons into small angles by substances in a highly divided state. Transmission measurements were made with the mechanical velocity selector in the energy regions 0.001 - 0.0025 ev, 0.005 - 0.01 ev, and 0.045 - 0.09 ev on a variety of materials in various states of subdivision. The total cross-sections for 0.0016-ev neutrons are given in tabular form for positions of the sample both close to and far from the neutron detector. The sample thickness as well as the particle size values and grain size values for the different materials, as obtained from electron micrographs and x-ray diffraction methods, respectively, are also noted. Although the data are inconclusive as to the effects of grain size, the fact that the thicker samples had smaller cross sections that the thinner samples in the far position only, suggests that the scattering is largely multiple. Further experiments tended to corroborate the conclusion that the large scattering observed in attributable to small-angle scattering.

NEUTRONS (continued)

1970 The Energy Spectrum of the Delayed Neutrons from O^{17} by Evans Hayward Phys Rev 75 917-919 (1949) Mar 15

This article is based on AECD-2379. An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. I-1860.

1971 N^{17}, a Delayed Neutron Emitter by Luis W Alvarez Phys Rev 75 1127-1132 (1949) Apr 15

This article is based on AECU-53 (UCRL-201). An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. 2-531.

1972 Nuclear Reactions and Level Widths by E P Wigner Amer J Phys 17 99-109 (1949) Mar

The author reviews and correlates some of the information which has been obtained during the last 10 years on the relationship between nuclear reaction rates and level widths. A few special aspects of the problem are discussed after a short theoretical introduction explaining the connection between nuclear reactions and radio signal transmission and the type of schematic representation used in the latter is applied to the former. After generalizing the Ladenburg-Kramers-Heisenberg dispersion formula [Rubinowicz in Geiger-Scheel's Handbuch der Physik 24 63 (1933)] the author discusses level spacing, level widths, and the average absorption of fast neutrons. Tabular data compiled from various sources on transition probability as a function of nuclear energy level width are given for reactions involving neutron bombardment of O^{16}, Al^{27}, Mn^{55}, Ni^{58}, Co^{59}, Cd^{113}, In^{115}, I^{127}, Eu^{153}, Ta^{181}, and Ir, and proton bombardments of Li^{7}, Be^{9}, C^{12}, and C^{13}. A table of neutron widths calculated from experimental cross sections for eleven nuclei is also given. 25 references.

1973 On the Inelastic Scattering of Fast Neutrons by Bernard T Feld Phys Rev 75 1115-1123 (1949) Apr 15

The available data on the inelastic scattering of fast neutrons are interpreted in terms of: (1) a detailed theory, developed by the author for the excitation of individual levels of the target nucleus, applicable when only a few levels of the target nucleus are involved (i.e., incident neutron energy only a few times the low lying level spacing of the target nucleus); and (2) the statistical theory of Weisskopf, applicable when the incident neutron energy is very much greater than the level spacing of the target nucleus (very many levels involved). The data of the Los Alamos group on the scattering of 1.5- and 3-Mev neutrons by Fe, W, and Pb indicate that Fe requires the first type of interpretation, W the second; Pb seems to be more similar to Fe than to W. The level system proposed by Elliott and Deutsch [Phys Rev 64 321 (1943)] on the basis of β-decay measurements is sufficient to explain the Fe data. The average spacing of the lowest W levels is derived as approximately 80 Kev. The large apparent level spacing of Pb is consistent with the stability of nuclei containing the "magic number" of 82 protons or 126 neutrons.

1974 Total Neutron Cross Sections of Compounds with Different Crystalline Structures by Lester Winsberg, David Meneghetti and S S Sidhu Phys Rev 75 975-979 (1949) Mar 15

This article is based on MDDC-1735. An abstract of the document has been listed in Abstracts of Declassified Documents 2 171 (1948) Mar 15.

1975 Upper Limits of the Fission Cross Sections of Bismuth, Lead, Mercury, Gold, Iridium, and Tungsten for 14-Mev Neutrons by Anne N Phillips, Louis Rosen and R F Taschek Phys Rev 75 919-922 (1949) Mar 15

This article is based on AECD-2196. An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. I-979.

NUCLEAR PROPERTIES

1976 A Compilation of the Non-Radioactive Nuclear Properties of the Naturally Occurring Isotopes by Elwin H Covey. AECU-190 (UCRL-290) Feb 15 1949 31p

This compilation includes most of the published data on the nuclear spins, magnetic moments, and exact masses of the naturally occurring isotopes known up to October, 1948. The report attempts to bring all this information together in one place so that the concurrence (or lack of it) of previous authors and compilers on given values for each isotope can be noted conveniently, and different values compared.

1977 On Some Possible Magnetic Properties of Liquid He_3 by L Goldstein. AECU-191 (LA-729) Mar 10 1949 6p

It is shown that on account of He_3 nuclei having spin $h/4\pi$, and a magnetic moment of -2.131 nuclear magnetons, the possibility arises that a given amount of this fluid may have a magnetic field around it. This would be due to the spontaneous nuclear ferromagnetism of this fluid caused by the Fermi-Dirac statistics followed by these atoms. Although the spontaneous magnetization would be due only to a relatively small fraction of the atoms, this may be strong enough to become observable and, perhaps, measurable.

1978 Atom Abundances and Periodicities in the Structure of the Nucleus (Atomhäufigkeit und Strukturperioden im Kernbau) by Richard A Sonder Schweizerische Mineralogische und Petrographische Mitteilungen 28 528-539 (1948) (In German)

The average composition of matter is interpolated from the composition of the earth's crust, earth's atmosphere, and the meteorites. In tables and curves the relative abundances of elements and isotopes are given. The curves reveal the existence of periodicities, which have been observed for the first time by Niggli (Die Leichtflüchtigen Bestandteile im Magma, Leipzig, 1920). The rules governing the relative abundance of nuclei have been found by the present author [Z Kristallographie 57 611 (1923)] to correspond very exactly to a crystallographic packing formula. This formula served then to predict nuclear and abundance periodicities, which are to-day confirmed by analytical data.

1979 Determination of e/m from Recent Experiments in Nuclear Resonance by H A Thomas, R L Driscoll and J A Hipple Phys Rev 75 992 (1949) Mar 15 (Letter to the editor)

Using the g value for the proton recently reported by Taub and Kusch [Bull Amer Phys Soc 24 No. 1, W8A (1949)] and the absolute value of the gyromagnetic ratio of the proton previously obtained by the authors [Phys Rev 75 902 (1949)] the ratio of e/m has been more precisely determined as $(1.75878 \pm .00016) \times 10^7$.

1980 The Determination of the Mass of N_7^{16} by Means of Interpolation by Tibor Z Szelenyi Phys Rev 75 1105-1106 (1949) Apr 1 (Letter to the editor)

A more exact value for the nuclear mass of $_7N^{16}$ has been obtained by utilizing an interpolation method which employs a plot of the mass defect differences of the isobars $X_{Z-1}{}^A - Y_Z{}^A = \Delta E_{4n}$ as functions of A (A = 4, 8, 12, ... 36, and Z = A/2). The mass of this nucleus has been determined to be 16.0102 ± 0.0007 MU by this method, whereas previously it had merely been located as lying in the range 16.065-16.011 MU.

1981 Exchange Moments of H^3 and He^3 by R Avery and E N Adams II Phys Rev 75 1106-1107 (1949) Apr 1 (Letter to the editor)

It has seemed worthwhile to reinvestigate the magnitude of the exchange moments of H^3 and He^3 using Yukawa potentials. Recent work [G F Chew and M L Goldberger Phys Rev 73 1409 (1948)] on interactions with the Yukawa radial dependence has had the result that a relatively large amount of tensor interaction is required to fit the low energy deuteron data, particularly if the tensor and central ranges are taken to be the same. A stronger tensor interaction would be expected to favor a correspondingly larger exchange moment. Using the simple mixture of ^2S and ^4D after the manner of Gerjuoy and

NUCLEAR PROPERTIES (continued)

Schwinger [Phys Rev 61 138 (1942)] and considering a radial dependence of the form $\exp\{-a(r_{12} + r_{23} + r_{31})\}$ 200 percent binding of H^3 was found on the assumption of all central forces. When the interactions involving a tensor force are introduced into the variational calculation no binding is obtained unless the tensor range is taken to be longer than that of the central forces. As a consequence the interaction finally adopted had a tensor range appreciably longer ($M \sim 245\ m_e$) than the Breit range. The minimum of energy (60 percent of the experimental binding energy) was found for a choice of the parameters:

$$a_S = 2.70/r_0, \quad a_D = 5.22/r_0, \quad D^2 = 2.6 \text{ percent},$$

where D^2 is the ^4D probability and r_0 is $e^2/m_e c^2$.

The calculated exchange moment of H^3 was 0.016 n.m., as compared with 0.035 n.m. obtained with the Gauss potential [R G Sachs Phys Rev 74 433 (1948)]. The results obtained are discussed and it is concluded that this exchange moment will not make a major contribution to the H^3 moment anomaly.

Parallel calculations with inclusion of the Coulomb energy made for He^3 in order to estimate the effects of the small difference between the H^3 and He^3 wave functions on the sums of the ordinary and exchange moments indicate that these effects are completely negligible.

1982 Is It Possible to Represent Elements, Whose Atomic Masses Are Divisible by 4, As Consisting of Helium Particles ? (Kann man sich die Elemente mit durch die Zahl 4 teilbaren Atomgewichten aus Helium-Partikeln aufgebaut denken ?) by Stefan Meyer and Agathe Koss-Rosenqvist Acta Phys Aust 2 124-132 (1948) (In German)

It is shown that the nuclei of chemical elements cannot consist of pre-formed nuclei of helium. Several interesting results are obtained when the stable elements are arranged in two evolutional lines ending with the two radioactive families of thorium and uranium.

1983 A New Measurement of the Packing Fractions of the Nickel Isotopes by A E Shaw Phys Rev 75 1011-1013 (1949) Apr 1

This article is based on AECD-2351. An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. I-1721.

1984 Nuclear Magnetic Resonance in Weak Fields by Richard M Brown and E M Purcell Phys Rev 75 1262-1263 (1949) Apr 15 (Letter to the editor)

The proton resonance in one liter of water at room temperature was observed at a frequency of 50 kilocycles per second in a very homogenous field of approximately 11.7 gauss which was produced by a large solenoid. The calculated magnetic field inhomogeneity over the volume of the sample was of the order of one milligauss. The observed line width was 7 milligauss, comparable, on a frequency scale, to the 30-cycle-per second modulation frequency and it is noted that in such a case the line width may be determined by the modulation frequency rather than by field inhomogeneities. Apart from the increased resolution thus obtained, the experiment provides a severe test of the theory [Bloembergen et al Phys Rev 73 679 (1948)], since the magnetic field involved is comparable in magnitude to the perturbing intermolecular magnetic fields.

1985 On the Difficulty of the Meson Theory of Nuclear Forces by Gentaro Araki Phys Rev 75 1001-1002 (1949) Apr 1 (Letter to the editor)

It is shown that the difficulties in the meson theories of nuclear forces caused by the presence of an r^{-3} term and divergent integrals are merely apparent so far as the pseudoscalar theory is concerned and consequently have no connection with the general defect of the contemporary field theory. The matrix element "W", of the two-nucleon potential, (as a function of the nucleon-meson interaction) is found by the Fourier theorem and the expression obtained is discussed. It is concluded that the previously noted difficulties are due to the unsuitable non-relativistic form used in the customary method of evaluation; therefore, the factor having a non-relativistic form must be determined in such a manner that the contribution from a relativistic region is not involved.

NUCLEAR PROPERTIES (continued)

1986 On the Origin of Chemical Elements (Zur Genesis der chemischen Elemente) by Stefan Meyer and Agathe Koss-Rosenqvist Acta Phys Aust 2 109-123 (1948) (In German)

An arrangement is suggested of chemical elements which may provide clues for a better understanding of their structure and, by pointing out the missing links, could direct further research. All the transitions from element to element can be represented by steps equal either to the sum 2 protons + 2 neutrons, or 2 protons + 4 neutrons. An explanation is given of the inverted order followed in the old periodic system by the pairs argon-potassium, cobalt-nickel, tellurium-iodine, and thorium-protoactinium. The "excessive" differences (more than 4 units) between the atomic masses of certain neighboring elements are also explained. The singularities are discussed which are displayed by the β-emitters potassium, rubidium, and lutecium, and by the α-emitter samarium.

NUCLEAR TRANSFORMATIONS

1987 Low Energy Cross Section of the D-D Reaction and Angular Distribution of the Protons Emitted by E Bretscher and A P French. AECD-2570 (LADC-240) Sept 17 1946 Decl Apr 18 1949 59p

The thick-target yield of the reaction $D + D \longrightarrow T + p + 3.98$ Mev has been measured, using a heavy-ice target, and observations have been made on the angular distribution of the protons. Experiments have been carried out in the region 15 Kev to 105 Kev incident deuteron energy. Evidence has been obtained that, even for very small bombarding energies, the angular distribution of protons in the center-of-gravity (c.g.) system does not become isotropic. The variation of the cross section with energy can only approximately be represented by a Gamow function.

1988 The Distribution of Nuclear Charge in Fission by L E Glendenin, C D Coryell and R R Edwards. AECD-2571 Sept 1 1948 Decl Feb 18 1949 40p For publication in NNES

The problem of nuclear charge distribution in the primary fission fragments is considered in the light of recent data on the fission yields of some shielded nuclides and other project data including those from gas sweeping experiments. A useful hypothesis of charge distribution based on the postulate of equal chain length is developed, and a quantitative distribution curve for the nuclear charge of primary fission products with given mass is presented. Other postulates of charge distribution in fission are considered and evaluated, and an attempt is made to consider all available data bearing on the subject.

1989 Independent Fission Yield of 9.2h Xe^{135} by E J Hoagland and N Sugarman. AECD-2574 nd Decl Apr 12 1949 9p For publication in NNES

The purpose of this experiment was to determine the fission yield for the formation of 9.2h and 12m Xe^{135} as a primary fission product. Aside from the theoretical importance of the phenomenon of independent formation as discussed in the survey volume (PPR Vol 9B Chap VI 1946), the formation of Xe^{135} directly in fission would increase the fission yield of the chain as determined from the activity of the 6.7h I^{135} parent, and thereby enhance its activity. It was found that ~5 per cent of the fissions leading to the formation of the chain 135 form Xe^{135} directly, thus leading to a total fission yield of the 9.2h Xe^{135} of 5.9 per cent.

1990 The Conservation of Energy and Momentum in Nuclear Reactions by B Carlson, M Goldstein, L Rosen and D Sweeney. AECU-195 (LA-723) Jan 28 1949 121p

Formulas are derived for the conservation of energy and momentum in nuclear reactions. Among the nuclear reactions considered are the following: $D + D \longrightarrow p + T$; $D + D \longrightarrow n + He^3$; $D + He^3 \longrightarrow p + He^4$; $D + T \longrightarrow n + He^4$; $p + T \longrightarrow n + He^3$.

1991 Some Excitation Functions of Bismuth by E L Kelly and E Segrè Phys Rev 75 999-1005 (1949) Apr 1

This article is based on AECU-88 (UCRL-207). An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. 2-947.

PARTICLE ACCELERATORS

1992 The Betatron (Le Betatron) by Joachim Dosse Rev Scientifique 86 357-367 (1948) Apr (Printed December 20, 1948) (In French)

This is a general outline of the theory and the construction principles of the betatron and the related instruments (synchroton, microtron). A list of references mentions 70 works on the subject since 1927. The mathematical part includes discussions on equilibrium orbits of electrons and on the stability of electrons on their orbits, and gives an introduction to a complete theory of the betatron.

1993 Note on the Rochester Cyclotron by S W Barnes, A F Clark, G B Collins, C L Oxley, R L McCreary, J B Platt and S N VanVoorhees Phys Rev 75 983 (1949) Mar 15 (Letter to editor)

Some of the construction details and operating data on the Rochester cyclotron are noted. This 130-inch cyclotron has accelerated protons out to a radius of 58 1/2″ or to an estimated energy of 240 Mev. Average currents of about 0.1 μa were measured at this radius and radio-autographs of the target show the beam to be about 1″ in height and well centered vertically on the probe. Eastman Kodak NTB plates placed along the probe show, among many proton recoil tracks, π^- and π^+ tracks.

PETROLEUM

1994 Gamma-Ray Well Logging by Robert E Fearon Nucleonics 4 No. 4, 67-75 (1949) Apr

The theory and applications of γ-ray well logging, as a means of locating new sources of petroleum, are discussed. Sampling, logging in a cased borehole, and the relative merits of thick-walled and thin-walled detectors are among the topics treated.

PHYSICS, GENERAL

1995 The Behavior of Thenoyltrifluoroacetone in Benzene and Water by E L King and W H Reas. AECD-2573 (BC-69) July 1947 Decl Apr 21 1949 37p

Various properties of thenoyltrifluoroacetone (TTA) which are of interest in the extraction of positive ions into organic solvents have been studied. The activity coefficient of TTA in benzene has been measured as a function of the TTA concentration. Large deviations from unity occur at concentrations above 0.1 moles per liter. It is shown that TTA forms a definite hydrate and its distribution coefficient and absorption spectrum are given. The rate of approach to equilibrium in the distribution of TTA between water and benzene has been studied under various conditions. The results are interpreted in terms of the behavior of the enol and hydrate form of TTA.

1996 Approximate Densities of Liquid He^3 between 1.27° and 2.79°K by E R Grilly, E F Hammel and S G Sydoriak Phys Rev 75 1103-1104 (1949) Apr 1 (Letter to the editor)

Tabulated data and curves are given for the approximate density of liquid helium as a function of temperature in the range between 1.27° and 2.79°K. A curve of the heat of vaporization of He^3 as a function of the temperature which was calculated from the density data is also given. The reliability of the results only permits the establishment of a smooth curve which has a maximum of 4.5 cal/g between 1.7° and 2.2°K. Further improvements in technique are being planned to facilitate the determination of a lambda-transition such as exists for He^4.

1997 Comparison of the Flow of Isotopically Pure Liquid He^3 and He^4 by Darrell W Osborne, Bernard Weinstock and Bernard M Abraham Phys Rev 75 988 (1949) Mar 15 (Letter to editor)

In order to determine whether liquid He^3 has a transition to a superfluid state such as that exhibited by liquid He^4, the isothermal flow of isotopically pure liquid He^3 through a narrow channel or superleak has been studied from 3.02°K to 1.05°K. The rate of flow of liquid He^3 was observed to decrease monotonically as the temperature was lowered. In contrast, the rate of flow of liquid He^4 through the same

PHYSICS, GENERAL (continued)

channel was observed to decrease as the temperature was lowered, until the λ-point was reached, and below this point the rate rose very sharply. A curve showing the mass rate of flow of the two isotopes as a function of the temperature is given. The results obtained clearly indicate that no superfluid transition occurs in He^3 down to 1.05°K. The experimental technique used was similar to that previously used by Giauque, Stout and Barieau (J Amer Chem Soc 61 654 (1939)). Although the authors note that the temperature obtained may not have been sufficiently low, it is concluded that the data lend support to the hypothesis that the λ-transition of He^4 is due to Bose-Einstein statistics.

1998 Separation of a Gas Mixture Flowing through a Long Tube at Low Pressure by R D Present and A J deBethune Phys Rev 75 1050-1057 (1949) Apr 1

This article is based on AECD-2411. An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. 2-249.

1999 Transmission through Dielectric by L J Chu. MIT Radiation Laboratory Report RL-113 Dec 11 1940 6p

When a wave hits a dielectric material of finite thickness comparable to the wave length, the ratio of power transmitted to the incident power S depends primarily upon (1) the conductivity and thickness of the dielectric and also upon (2) the angle of incidence. The effects are discussed separately.

PHYSICS, NUCLEAR

2000 Experimental Nuclear Physics Volume II by A C G Mitchell. AECU-187 (NEPA-926) nd 79p

The contents of this volume have been edited from original notes used at the NEPA Summer Seminar, June-September 1947. A brief history of radioactive phenomena discoveries followed by discussions of radiation detection instruments, the radioactive families and radioactive decay, the systematics of nuclei, gamma rays and the beta ray lines, and the scattering of alpha particles are presented.

2001 The Elementary Particles of Physics by Carl D Anderson Amer Scientist 37 193-201 (1949) Apr

The history of the discovery of the various elementary particles is reviewed and some of the more recent advances in nuclear physics are discussed briefly.

2002 Guide to Literature of Elementary Particle Physics, Including Cosmic Rays by J Tiomno and John A Wheeler Amer Scientist 37 202-218 (1949) Apr

This guide to the literature of elementary particle physics is divided into two parts. The first part consists of a numbered list of major topics in the field to serve as an outline and the bibliography itself is given in Part Two. The bibliography, which includes some papers published as recently as December, 1948, is not complete, but should be helpful since so much of this material must necessarily be consulted in the original form.

PHYSICS, NUCLEAR - METHODS OF MEASURING

2003 Improved Baffle System for Helical Focussing β-Ray Spectrometer by L Feldman and C S Wu. AECD-2568 Mar 4 1949 Decl Mar 20 1949 1p Proposed for publication in Bull Amer Phys Soc

This document is in abstract form; it is reproduced below in its entirety.

A new ring focussing baffle system for the helical focussing beta-ray spectrometer has been designed and built to take advantage of the maxiumum solid angle as resolution relationships recently pointed out by theoretical investigations of quadratic focussing [S Frankel Phys Rev 73 804 (1948); E Persico Phys Rev 73 1475 (1948)]. The existence of the ring focussing property was originally pointed

PHYSICS, NUCLEAR - METHODS OF MEASURING (continued)

out by Witcher [Phys Rev 60 32 (1941)] and this principle was used in the design of the original baffle. However to obtain best resolution for a given solid angle, the initial angle between the axis and the electron beam should be between 30° and 60°. The new baffle was designed to utilize the optimum condition in which the initial angle is between 32° and 44° as compared with the 8.9° to 18.7° angle of the original baffle. Preliminary investigations indicate a factor of five increase in transmission of the new baffle over the original baffle with the same resolution. This increase in transmission of the spectrometer is a great improvement in the investigation of beta spectra of sources of very low specific activity.

2004 An Alpha Scintillation Counter for Health Physics and Dust Study Applications by B Cassen, C W Reed, L Curtis and L Baurmash. AECU-193 (UCLA-14) Mar 17 1949 16p

The design, construction and testing of an alpha scintillation counter developed especially for very low rate counting problems encountered in some health physics and dust study applications, is described. The prototype instrument has a number of advantages and few disadvantages over Geiger or proportional counters available for this type of measurement.

2005 Accurate Determination of the Deadtime and Recovery Characteristics of Geiger-Müller Counters by Louis Costrell J Research Natl Bur Standards 42 241-249 (1949) Mar

A brief description of the theory of operation of Geiger-Müller counters is presented, with special emphasis on the deadtime and recovery characteristics. An electronic gating instrument is described that has been developed for the determination of deadtime and recovery characteristics to an accuracy of 1% or 2 microseconds. Experimental data are presented showing variation of deadtime and recovery time with counter pressure and overvoltage.

2006 Action of Borate of Sodium on the Conservation of the Latent Image in the Photography of the Trajectories of α-Particles (Action du borate de sodium sur la conservation de l'image latente dans la photographie des trajectoires des particules α) by R Coppens J Phys et Radium 10 56-57 (1949) Feb (In French)

A series of Ilford C2 plates were submerged for 15 min in solutions of borate of sodium crystallized as $B_4O_7Na_2 \cdot 10H_2O$ of various concentrations and then dried. They were next exposed to a radioactive polonium source and then preserved for future development at increasing time intervals. Curves of the percentage of visible trajectories and of the duration of the persisting number of trajectories as functions of the borate concentration are shown. The results obtained indicate that within large limits, borate of sodium retards the disappearance of the latent image. The duration of the conservation of this image varies with the concentration of borate with which the plate used had been treated. A solution containing 10 to 30 gm of borate per liter seemed to give the maximum image conservation.

2007 Crystal Counters -- I by Robert Hofstadter Nucleonics 4 No. 4, 2-27 (1949) Apr

The available literature on crystal counters is reviewed and the author describes, as well, some of his work in this field. The theory of operation and the properties of crystal counters are discussed. Methods of preparation of a number of crystals which have been investigated to date are described and calculated values which have been obtained from the data are given in tabular form. The polarization produced by β-particles and penetrating radiation is discussed. Numerous diagrams and photographs of the counters and the apparatus associated with them are given. 13 figures. 2 tables. 57 references.

2008 Diamond Drill Hole G-M Counter by K Feldman and G M Wright Can J Research 27F 23-27 (1949) Feb

A portable instrument for making γ-ray surveys of diamond drill holes to depths of 1000 ft. is described. The problem of constructing a waterproof probe is discussed and the authors note that tubes, coated with rubber, give promise of suitability in this respect. Various modifications in the electronic circuits commonly used in other portable counters have been made and a diagram of the modified circuit, which is discussed in detail, is given.

PHYSICS, NUCLEAR - METHODS OF MEASURING (continued)

2009 Fluorescence of Anthracene Excited by High Energy Radiation by Louise Roth Phys Rev 75 983 (1949) Mar 15 (Letter to the editor)

Single crystals of anthracene were prepared by a method similar to that of P. R. Bell [Phys Rev 73 1405 (1948)] and used for scintillation counters. The spectra of the scintillations produced by high energy bombardment have been studied and compared with the fluorescence bands produced by ultraviolet excitation. Spectrograms of the fluorescence excited by copper Kα-radiation, 10-Mev deuterons, and a 10-mc radium-beryllium neutron source were made with a small Hilger quartz spectrograph using Eastman 103-0 plates. No attempt was made to distinguish between the effects of neutrons and γ-rays. A 5 minute exposure to X-rays with a 0.1-millimeter slit was sufficient to bring out the bands found whereas a 10-minute exposure was used with the deuteron beam and 24 hours with the radium-beryllium. In each case 3 bands were observed between 4120 and 4720A with the most intense band at 4440A. To correlate the known bands with the counting properties, counts were taken with a series of Wratten filters placed between the scintillating crystal and the 931-A photo-multiplier tube using a Co^{60} γ-source at a constant distance from the crystal. Counts were taken at different pulse heights with and without each filter. The data taken corroborate earlier indications that the fluorescence of anthracene is particularly suited to scintillation counting with a 931-A or 1P-21 photo-multiplier tube, since these tubes are most sensitive in the 3500-4500 A spectral range.

2010 Some Properties of the Parallel Plate Spark Counter I by R W Pidd and Leon Madansky Phys Rev 75 1175-1180 (1949) Apr 15

This article is based on AECU-62 (BNL). An abstract of the document has been listed in Nuclear Science Abstracts as Abstract No. 2-961.

2011 Technical Manual of Battery Geiger Probe Monitor MK 1 by N F Moody. National Research Council of Canada Report IM-3 Sept 1948 26p

The manual supplies information on the following: specifications, instructions for putting into service, operating instructions, use of time constant switch, reduction in weight, battery replacement, simplified circuit description of counting rate unit, sources of error, testing with regular pulses and circuit description of the H.T. supply unit.

PHYSICS, THEORETICAL

2012 The Electromagnetic Shift of Energy Levels by J B French and V F Weisskopf Phys Rev 75 1240-1248 (1949) Apr 15

The effect of the interaction with the radiation field in changing the energy levels of an electron in an external field is calculated using the conventional form of perturbation theory. The infinite self-energy of the electron which occurs in the same approximation is removed by subtracting from the Hamiltonian a "mass operator" M. The criteria used in deriving M are that it should correctly give the self-energy for a free electron in the absence of an external field and that the amended Hamiltonian should give a properly covariant form for the level shift in an external field. It is pointed out that M is uniquely determined by these requirements. The results give 1051 mc/sec. for the $2s_{1/2} - 2p_{1/2}$ separation in hydrogen and also show the surplus magnetic moment of the electron as $\alpha/2\pi$ Bohr magnetons, as first found by Schwinger. The amended Hamiltonian can be used for determining the radiative corrections for other processes.

2013 The Indefinite Metric in Relativistic Quantum Mechnics by K J Le Couteur Proc Roy Soc London 196 A 251-272 (1949) Mar 22

There are many problems of relativistic quantum mechanics which cannot be treated by working with a positive definite metric in the vector space of the fully quantized system. It is shown that, independently of the signs of energy and charge in the c number theory, any relativistic wave equation can be quantized and interpreted in terms of positive energies by use of an indefinite metric of suitable signature. A powerful method of obtaining positive definite transition probabilities from an indefinite

PHYSICS, THEORETICAL (continued)

metric is introduced and the concept of "negative probability" is entirely avoided. The transition probabilities are defined as the squared matrix elements of a unitary matrix T, which is obtained from the solution of the Schrödinger equation by means of a special transformation. These techniques make it possible to treat relativistic wave equations which describes particles with several mass and spin states and to give a satisfactory account of the transition between two such mass states, a problem which is otherwise quite intractable. The relationship between spin and statistics is discussed and it is concluded that, apart from the special cases of spin 0, 1/2, 1, there is no necessary connection between spin and statistics. 21 references.

2014 On the Canonical Reduction of Quadratic Forms by R G Helsel Phys Rev 75 1088-1089 (1949) Apr 1

The standard method for simultaneously reducing two quadratic forms in n variables to sums of squares depends upon finding a set of n independent eigenvectors. The same method is applicable to the reduction of a hermitian matrix to diagonal form by a unitary matrix, as is done in quantum mechanics. This method is based on the following fundamental theorem concerning eigenvectors: If A and B are two hermitian matrices of order n, A being positive definite, and if λ_i is a k-fold root of the secular equation $|B - \lambda A| = 0$, then the equation $(B - \lambda_i A)\xi = 0$ has k independent solutions. In other words, there are k independent eigenvectors corresponding to a k-fold root of the secular equation. A proof is given for this theorem which, as the author notes, is concise and at the same time quite elementary.

2015 On the Quantization of a Unitary Field Theory by R J Finkelstein Phys Rev 75 1079-1087 (1949) Apr 1

In a unitary field theory particles appear not as singularities but as small volumes in which energy and charge of the field are concentrated. In a theory of this nature, which is necessarily non-linear, all properties of the particles, such as their equations of motion, follow from the field equations. It is pointed out in this paper that the non-linearity present in the usual classical field theories is sufficient to permit the existence of particle-like solutions under certain conditions and that it is therefore possible to derive a class of classical unitary theories by postulating that solutions of the usual classical theories are physically admissible only if they are free from singularities. The author has studied the quantization of such a theory without specializing the Lagrangian. Momentum (G_α) and angular momentum ($M_{\alpha\beta}$) appear naturally and a relativistic definition of the position (X_α) of a particle may be given in terms of $M_{\alpha\beta}$ and G_α. The commutators of these particle observables (X_α, G_α, $M_{\alpha\beta}$) with each other are calculated and found similar to those postulated in the Snyder formalism [Phys Rev 71 38 (1947)] which quantizes space-time; these commutators reduce to the usual ones for non-relativistic velocities. (The quantized Born-Infeld theory did not agree with the usual quantum theory of particles even in the non-relativistic limit, because it was not strictly unitary.) The connection between velocity and momentum, and the equation of motion of particles which follow from the field equations are the usual ones. Operators for mass and charge may be defined; these mutually commute and permit the usual classification of the elementary particles according to mass and charge. Magnetic moment and charge commute with the total electromagnetic field. Particle observables and observables describing the external field may not commute in general.

2016 The Quantum Mechanics and the Second Law of Thermodynamics (Die Quantenmechanik und der zweite Hauptsatz der Thermodynamik) by Max Born Ann Physik 3 107-114 (1948) Aug (In German)

The position of the entropy principle in the modern quantum theory is discussed. It is shown that the concept of irreversibility is already implied in a mechanical basis of thermodynamics, viz. in the purely quantum-mechanical formula expressing probability as a function of time. According to this formula, elementary dynamic processes are statistically independent transitions similar in this to radioactive transformations. The essence of irreversibility being contained in these formulations, the introduction of the entropy concept helps to throw a stronger light upon the relationships involved.

PHYSICS, THEORETICAL (continued)

2017 Uncertainty Principle by W L Cowley Nature 163 492 (1949) Mar 26 (Letter to the editor)

Two objections to the commonly used illustration of the uncertainty principle, i.e., by supposing that a fundamental particle is viewed through a microscope to determine its position at the same time as a measurement is made of its momentum, are presented. The objections raised are concerned with the following: 1) the application of an optic formula, which essentially gives the effect of the mass action, to the action of an isolated quantum or photon, and 2) the fact that the optics formula involved (concerning the resolving power of a microscope) does not primarily give a fundamental limit to observation, but rather a formula of convenience, implying that it is difficult for the unaided eye to differentiate between 2 ring patterns, but making no claim that the patterns do not differ. The author concludes that although the illustration discussed may be argued on the basis of quantum mechanics, the classical arguments do not validate it.

2018 Unitary Quantum Electron Dynamics II by H J Groenewold Proc Koninklijke Nederlandsche Akademie van Wetenschappen 52 No. 3, 226-239 (1949)

After acknowledging the difficulties to be expected, a unitary charge theory in which advanced and retarded interaction at a distance are possible is developed. It is noted that even an imperfect formulation might be expected to prove helpful with respect to certain aspects of the dualistic charge-field theory. In particular, some of the properties of the field which are less conspicuous in the common treatment might thus be clarified. The equations of motion of electrons in such a theory are treated. It is found that if the interaction is resolved into a transverse part and a non-transverse part, the latter can be reduced to a simultaneous Coulomb interaction.

RADIATION SICKNESS

2019 The Treatment of Radiation Sickness with Adrenal Cortical Hormone (Desoxycorticosterone Acetate) A Preliminary Report on Fifty Cases by Friedrich Ellinger, Bernard Roswit and Samuel M Glasser Amer J Roentgenol and Radium Therapy 61 387-396 (1949) Mar

The value of DCA (desoxycorticosterone acetate) in the treatment of radiation sickness was studied in a series of 50 patients. All of these patients exhibited nausea and/or vomiting besides other symptoms of radiation sickness which was a result of radiation therapy administered for a variety of both benign and malignant conditions. Only 3 of the 50 patients failed to respond to DCA therapy. In 37 cases complete relief from nausea and/or vomiting was obtained; the remaining 10 cases showed some improvement. Extensive data on cases are given in tabular form. A table is given correlating the DCA results with the body section which had been subjected to radiation therapy and a special chart suitable for accurate and subjective recording of the symptoms and progress of radiation sickness is also included. 6 tables.

RADIOACTIVITY

2020 Element 43 Activities from Pile-Irradiated Ru by L E Glendenin. AECD-2561 (ANL-NS-139) nd Decl Apr 18 1949 12p For publication in NNES (See also MDDC-1493-E)

Two radioactive isotopes of element 43 have been produced by neutron irradiation of Ru in the Clinton pile. The first of these has a half-life of 2.7d and decays by emission of 0.75-Mev β-radiation, 1.0-Mev γ-radiation and approximately 17.5-Kev x-rays. This isotope apparently decays by both β-emission and K electron capture and is assigned tentatively a mass of 98 (with mass 100 also remaining as a possibility). The second isotope has a half-life of about 60d and appears to decay by K electron capture with the emission of soft electrons and γ-radiation. This activity may be the daughter of the 2.8d Ru^{97} reported by Sullivan, Sleight and Gladrow. Effective pile neutron cross sections are calculated for both isotopes.

RADIOACTIVITY (continued)

2021 The Beta-Ray Spectra of Cu^{64} and the Ratio of N + /N − by C S Wu and R D Albert. Phys Rev 75 1107-1108 (1949) Apr 1 (Letter to the editor)

This article is based on AECD-2403. An abstract of this document has been listed in Nuclear Science Abstracts as Abstract II-282.

2022 Difference in the Recoil Energy of the Br^{80} Isomers Following Neutron Capture by Paul P Capron, Edgard Crèvecoeur and Maurice Faes J Chem Phys 17 349-350 (1949) Mar (Letter to the editor)

Experiments on the following reactions $HBr + n \xrightarrow{k_6} HBr^*$, $HBr + n \xrightarrow{k_7} H + Br^*$ are described which indicate that the complex nucleus emits γ-rays in cascade so that the recoil energy of the Br^{80} (18 min.) nucleus is smaller than the recoil energy of the Br^{80} (4.5 hr.) nucleus. As a consequence of this, the probability of molecular dissociation is different as is also the charge and the nature of the ions produced. The results obtained verify the earlier values for k_6 and k_7 obtained by Hamill and Williams [J Chem Phys 16 1171 (1948)]. Curves showing isomeric filiation of the bromine activities, both with and without an electric field, are shown. Tabulated data and curves obtained on the ratio of the activity of the two isomers are also shown.

2023 The Disintegration of Se^{75} by Michel Ter-Pogossian, J Eugene Robinson and C Sharp Cook Phys Rev 75 995-998 (1949) Apr 1

The photoelectrons produced in both lead and uranium radiators by the gamma-rays following K-capture in Se^{75} have been investigated using a uniform field, semi-circular magnetic spectrometer. The gamma-rays thus found have energies of 76 kev, 123 kev, 137 kev, 283 kev and 405 kev with a possible radiation at approximately 99 kev. A tentative decay scheme is proposed.

2024 Energy of Beta-Rays from K^{40} by J J Floyd and L B Borst Phys Rev 75 1106 (194^) Apr 1 (Letter to the editor)

A new sample of K which had been enriched about 100-fold in K^{40} (Obtained through the Stable Isotope Division, Atomic Energy Commission, Oak Ridge, Tennessee) has been examined to redetermine the maximum β-ray energy, previously reported as $E_m = 1.9 \pm 0.2$ Mev [Phys Rev 74 989 (1948)]. From aluminum absorption measurements the newly-determined result is $E_m = 1.45 \pm 0.15$ Mev. A penetrating gamma-ray component was observed, the ratio of gamma-counts to β-counts being 0.0014. From the fact that if a thin Na^{24} sample is substituted, this ratio becomes 0.046, it was possible to obtain an approximate ratio of the disintegration constants for gamma and β-emission $\lambda_\gamma/\lambda_\beta = 0.05 \pm 0.01$. The β-ray disintegration constant, has also been redetermined as $\lambda_\beta = 4.3 \pm 0.4 \times 10^{-10}$/yr. From this the value of the gamma-ray disintegration constant has been determined as $\lambda_\gamma = 0.21 \pm 0.05 \times 10^{-10}$/yr.

2025 Erratum: Screening and Relativistic Effects on Beta-Spectra by C Longmire and H Brown Phys Rev 75 1102 (1949) Apr 1 (Letter to the editor)

An error in a previously published paper [Phys Rev 75 264 (1949)] is noted. The calculations which are given neglect the energy dependence of the free-electron S wave function at the origin. If this correction is made the following equation is obtained:

$$F_c \pm (Z, W) = F(Z, W \pm D_o) \left(\frac{W - mc^2 \pm D_o}{W - mc^2} \right)^{1/2}$$

It is noted that this modification approximately interchanges the electron and positron corrections, making the positron correction the larger of the two and that the screening correction for electrons is almost negligible. Thus curve (b) in Fig. 4 ought to be a horizontal line. This correction improves the agreement between these results and those obtained by Rose [Phys Rev 49 727 (1936)] and Wu and Albert [Phys Rev 75 315 (1949)].

RADIOACTIVITY (continued)

2026 Radioactive Emanating Power and Ultrasonic Treatment by Marten Martensson and Ole Lamm Nature 163 447 (1949) Mar 19 (Letter to the editor)

The influence of ultrasonic treatment on radioactive emanating power has been investigated. A dilute solution of aluminum chloride was precipitated in the cold with ammonia in the presence of radium-thorium. The carefully washed precipitate was centrifuged and dried. Measurements were made by the streaming method for radium-thorium [Zimens, Z Physik Chem 37B 236 (1937)] which affords an almost instant reading of the relative changes in the emanating power. The sample was exposed to 1500 kc ultrasonic waves and an immediate increase in emanating power was observed: in a typical case a 26% increase was observed. These preliminary experiments seem to indicate that treatment with ultrasound brings about a disintegration of the agglomerates of the aluminum oxide hydrogel. Another interpretation is possible, namely, that the ultrasound may have an influence on the amount of water absorbed by the gel, thus causing a change in the emanating power [Hahn and Blitz, Z Physik Chem 126 323 (1927)].

2027 Radioactive Isotopes of Platinum and Gold by Geoffrey Wilkinson Phys Rev 75 1019-1029 (1949) Apr 1

Using the 60-inch Crocker Laboratory cyclotron, bombardments have been made of iridium and platinum with 19-mev deuterons, of iridium with 38-Mev α-particles, and of platinum and gold with fast and thermal neutrons. Radioactive isotopes of iridium, platinum, and gold were chemically separated and the radiation characteristics studied. Decay and absorption curves are given. 11 fig. 12 ref.

2028 Radioactive Thallium Isotopes Produced from Gold by D A Orth, L Marquez, W J Heiman and D H Templeton Phys Rev 75 1100 (1949) Apr 1 (Letter to the editor)

Three radioactive isotopes of thallium have been observed following the bombardment of gold metal with 38-Mev helium ions. A composite decay curve for the radioactivity of a purified thallium fraction is shown; the fraction was found to consist of 1.8-hour Tl^{198}, 7-hour Tl^{199} and 27-hour Tl^{200}. From absorber measurements it is concluded that these isotopes decay by electron capture which would be expected from the fact that they are neutron-deficient and are isobaric to stable mercury isotopes. Further experiments suggest that the reactions $(\alpha,3n)$, $(\alpha,2n)$ and (α,n) lead to the observed isotopes Tl^{198}, Tl^{199} and Tl^{200}, respectively.

2029 Radioactivity of K^{40} by Robert E Stout Phys Rev 75 1107 (1949) Apr 1 (Letter to the editor)

A determination of the β-radioactivity of K^{40} has been made by an internal calibration of KCl sources with standardized amounts of Na^{24}. The corrections used and other experimental details are described, and tabulated data are given for the ratio of counting rates, i.e. Na^{24} betas/K^{40} betas, as a function of source thickness for thicknesses of 43, 63, 74, 79 and 97 mgm/cm^2. An average of these data results in a value of 30.6 ± 2.0 betas/sec/gm for the specific activity of ordinary potassium.

2030 Regularities in the Disintegration Energies of β-Emitters (Gesetzmässigkeiten in den Zerfallsenergien von β-Strahlern) by Kurt Sitte Acta Phys Aust 2 1-12 (1948) (In German)

The empirical rule given by Feather [Proc Roy Soc Edinburgh 62 211 (1946)] for the determination of energies of successive β-disintegrations is being here explained and enlarged, by the use of some general elementary principles governing the structure of the nucleus. The enlarged rule is submitted to the test of the recently acquired data, and applied to the examination of some of the disintegration processes in the uranium fission which have not been clearly understood. The enlarged rule covers a regularity concerning the disintegration energies of unstable nuclei with equal neutron excesses. The application of these findings to the unstable products of the uranium fission confirms the idea of sinuosities in the "valley botton" of the energy surface.

RADIOACTIVITY (continued)

2031 Relation Between Half-Life and Energy in Alpha-Decay by I Perlman, A Ghiorso and G T Seaborg Phys Rev 75 1096-1097 (1949) Apr 1

Using recently obtained data on new alpha-particle emitters [Phys Rev 74 1740 (1948)], some correlations between alpha-energy and half-life have been obtained which have resulted in some new conclusions regarding the effect of nuclear type on this relationship. A plot of the logarithm of the alpha-half-life as a function of the alpha-energy for even-even nuclei is given and discussed. All of the even-even alpha-emitters for which both the alpha-half-life and the energy are known are included, while those species which exhibit branching decay with an unknown proportion of orbital electron capture are excluded. The even-even species are seen to fall on seven nearly parallel lines corresponding to the elements polonium, emanation, radium, thorium, uranium, plutonium and curium. Three exceptions, i.e. Po^{206}, Po^{208} and Po^{210}, are noted and discussed. From these curves the following characteristics are noted for other nuclear types: 1) even-odd nuclei of an element lie above the curves for the even-even isotopes of that element signifying an abnormally long half-life and on the average have longer half-lives by a factor of about five over what might be predicted on the basis of the even-even nuclei; 2) deviations are much greater for the odd-odd nuclei than for either of the other two species of nuclei since on the average these isotopes have longer half-lives by a factor of some 10 to 20 than indicated by predictions from the hypothetical curves. In the case of isotopes with more than one alpha-group, partial alpha-half-lives have been calculated and the deviations noted are for the least forbidden group. A few of the possible theoretical implications of these results are noted.

2032 The Standardization of Co^{60} by W B Mann. National Research Council of Canada Report CRC-408 Sept 15 1948 11p

The activity of a solution of Co^{60} in 0.1 N HCl was measured with coincidence counters, and the results compared with values obtained by the National Bureau of Standards and Oak Ridge National Laboratory for the same solution. The results from the three laboratories are in good agreement and has enabled the Bureau of Standards to issue certified Co^{60} solutions.

RADIOTHERAPY

2033 Beta Rays in Ophthalmology by James I Moore Modern Med 17 No. 7, 70-71 (1949) Apr 1

Beta-irradiation therapy for superficial lesions of the eye is discussed. The following pertinent facts are noted: 1) lymphoid tissue, newly formed blood vessels, and tumor cells are particularly susceptible; 2) individual cells are most sensitive during mitotic division; 3) the least differentiated tumors are the most sensitive. Some of the lesions in which β-therapy is beneficial are: lymphoma and overgrown lymphoid tissue in the conjuctiva; suppression of early cases of vernal conjunctivitis; vascularization of the cornea following ulcers, chemical burns, trauma, or keratitis; tuberculous keratitis; epitheliomas of cornea and limbus; senile keratoses (if small, raised, bright hemangiomas are found); pterygia; papillomas of the skin, warts, and granulation tissue on the eyelids or globe; keloid scars on the lids; and fibrotic conjuctival flaps. Among ocular lesions not benefited even by extensive β-therapy are the following: corneal dystrophies, old dense corneal scars without blood vessels, dark moles of the lid, sebaceous cysts, chalazions, xanthelasmas, nodular scleritis, and episcleritis.

2034 Cancer of the Cervix by Herbert F Traut Calif Med 70 297-300 (1949) Apr

The etiology, pathology, clinical characteristics, and treatment of cancer of the cervix are reviewed briefly. It is noted that operation should be the primary treatment only in cases treated at an early stage and that the combined treatment (radium intracervically to 4,000-6,000 milligram-hours followed by X-ray, 2,000 to 3,000 r through four ports) seems to give the best results obtained from radiation therapy alone.

RADIOTHERAPY (continued)

2035 Clinical Trials of Tetra-Sodium 2-Methyl-1 : 4-Naphthohydroquinone Disphosphate, in Conjunction with X-Ray Therapy by J S Mitchell Brit J Cancer 2 351-359 (1948) Dec

Clinical trials of large doses of tetra-sodium 2-methyl : 4-naphthohydroquinone diphosphate, a synthetic vitamin K substitute have been made on 116 patients with advanced malignant tumors in an attempt to improve the results obtained with X-ray therapy. The compound is of low toxicity and can be administered by intramuscular or intravenous injection. However, large intravenous doses produce focal pain in the region of the tumor in some cases, especially where there is bone involvement. A general survey of the use of the compound, administered by intramuscular injection, in combination with X-ray therapy, showed an unexpectedly good palliative response in at least 23 out of 73 patients with various common types of advanced malignant tumors, other than carcinoma of the bronchus. In a small series of histologically verified cases of inoperable carcinoma of the bronchus, the treated group of 9 cases who received X-ray therapy and the compound by intramuscular injection, showed a mean time of survival after the beginning of X-ray treatment of 7.5^{6} months, while the control group of 13 cases, receiving only X-ray therapy, had a mean survival time of 4.2^{3} months. For the members of the treated and control groups who received palliative X-ray therapy, the corresponding mean survival times were 8.0^{0} months and 3.2^{2} months. Intravenous administration of the compound has been used in 20 cases and was used alone in 10 very advanced cases; in 3 of the latter there was at least subjective improvement. The author concludes that tetra-sodium 2-methyl-1 : 4-naphthohydroquinone disphosphate in large doses produces a small but useful improvement in the palliative results of X-ray therapy in some cases of advanced cancer.

2036 Conservative Irradiation of the Nasopharynx by Harry H Haggart Ohio State Med J 45 357 (1949) Apr

The value of radium irradiation of the nasopharynx is discussed and certain precautions advisable in preventing overdosage are noted. Some sources of potential danger with respect to the latter are the wide variations among the various types of applicators in use and the possibility that an incomplete case history with respect to previous radiation treatment has been obtained. A recommended procedure which carefully limits dosage, is given for treatment of this type.

2037 Depth Dose Measurements for 250 KV. Roentgen Rays by Carl B Braestrup, Gordon H Cameron and Patricia McClement Amer J Roentgenol and Radium Therapy 61 397-401 (1949) Mar

Earlier depth dose measurements made by Braestrup have been extended to include 250 kv. roentgen radiation. The measurements were made in a "presdwood" phantom with a density of 0.985 gm per cc as previously described [Radiology 42 258 (1944)]. A thimble-type ionization chamber, in conjunction with a projection-type lead-shielded electrometer, was used to measure the radiations. The results obtained are shown graphically in the form of curves of "roentgens per 100 r in air" as a function of the depth in cm for a range of 0 to 20 cm. Tabulated dosage calculations for target skin distances of 50, 70, and 80 cm are given in terms of skin dose to permit direct calculation of the tumor dose in percentage of the radiation received by the skin. Another table is also given in terms of 100 r in air for the convenience of radiologists who calculate in terms of the air dose. The results obtained are in general agreement with those obtained by Exner and Packard [Radiology 44 367 (1945)], although the depth dose values obtained by the authors (using considerably different equipment) are somewhat higher. This discrepancy is consistent with a similar discrepancy observed at 200 kv. The results obtained indicate a definite improvement in the depth dose as the quality is increased from a half-value layer of 2 to 3.2 mm of Cu, i.e., it is possible to thus increase the tumor dose at a given depth for the same exposure of the skin.

RADIOTHERAPY (continued)

2038 The Rational Therapy of Carcinoma of the Cervix by Jack L Loudermilk J Indiana State Med Assoc 42 327-332 (1949) Apr

Various aspects of the diagnosis and treatment of carcinoma of the cervix both by surgery and radiations are discussed. The radiation therapy facts which are relevant are noted and the average tolerances of various tissues in the pelvis are given. It is noted that a minimum of 5,000 r given to the entire tumor in less than thirty days is necessary for cure and that it is necessary to achieve this without exceeding the tolerance of the rectum. The criteria used in selecting treatment are given and suitable treatment for cases in various categories is outlined.

2039 Reactions to X-Ray and Radium Therapy in the Treatment of Cancer of the Uterine Cervix by Daniel C Morton and John A Kerner Amer J Obstet and Gynecol 57 625-636 (1949) Apr

The reactions of normal tissues as a result of radium and roentgen treatment of the pelvis in cases of cervical cancer are discussed. The various specific reactions which can occur are described in some detail. Extensive data on various undesirable reactions to radium therapy and X-ray therapy and mortality rates as a result of such reactions are given in tabular form. It is noted that, in general, the severity of the reactions increases with dosage, particularly with respect to late reactions. Since the incidence of complications was definitely greater in cases where both radium and X rays were used, the importance of reducing the radiation received by the normal tissues in such cases is emphasized. The necessity of obtaining further data on the radiosensitivity of tumors is also suggested as a means of reducing the administered dosage. Other measures which the authors suggest warrant further investigation are: the antibiotics, the role of palliative surgery in cases of irradio-necrosis without recurrence, continuous hospitalization during roentgen radiation therapy and the determination of isodose curves for the method of treatment in use, so that over-radiation can be avoided on a more precise mathematical plan. 10 tables 16 references.

2040 The Use of Autoradiographs in the Quantitative Determination of Radiation Dosages from Ca^{45} in Bone by Robert A Dudley and Brown M Dobyns Science 109 327-328 (1949) Apr 1

An autoradiographic technique capable of quantitatively measuring local dosage rates in tissue, currently being applied to the study of radioactive Ca^{45} dosages in bone, is described. The technique is similar to that described by Axelrod and Hamilton [Amer J Path 23 389 (1947)] in their radioactive sulfur and arsenic studies of mustard gas and lewisite concentration in the skin and eye tissues. It consists of making an autoradiograph of the tissue being studied, producing calibration exposures from radioactive sources of known activity on the same film, developing the tissue and calibration exposures simultaneously, and comparing their blackening microphotometrically. The application of the technique to studies on the Ca^{45} bone-uptake in the dog is discussed and autoradiographs and a microphotometer record obtained in such experiments are given. It is noted that, if the same dilution that exists in dogs also exists in humans, the maximum local dosage rate would be a permissible 0.034 reps/day.

RARE EARTHS AND RARE EARTH COMPOUNDS

2041 Cathodo-Luminescence of Rare Earths in Coal Ash by Bibhuti Mukherjee Nature 163 402 (1949) Mar 12 (Letter to the editor)

The application of cathodo-luminescence to the detection of the presence of rare earths is qunatities too small for spectrographic analysis is described. Coal ash containing such quantities of the rare earths was mixed with calcium oxide and the presence of manganese acting as an activator resulted in the bright luminescence observed. The manganese band was suppressed in the presence of rare earths in the ash. The rare earth activators of luminescence in coal ash were found to be samarium, dysprosium, europium, erbium, and possibly terbium and neodymium. It is noted that the rare earths of even atomic number, i.e., samarium-62 and dysprosium-66 were the chief activators.

RARE EARTHS AND RARE EARTH COMPOUNDS (continued)

2042 The Characteristic Radiations of Praseodymium (142) by C E Mandeville Phys Rev 75 1017-1019 (1949) Apr 1

The nineteen-hour Pr^{142} emits 2.22-Mev nuclear beta-rays (aluminum absorption) and gamma-rays having a maximum energy of 1.74 Mev as determined by coincidence absorption. Evidence is considered which leads to a somewhat lower value for the energy of this gamma-ray. Lead absorption measurements indicate a soft component exists at 0.17 Mev. Beta-gamma-coincidence data reveal the presence of a soft beta-ray spectrum of low intensity having an end point at 215 Kev. The hard beta-rays are non-coincident with gamma-radiation and are thus considered to be associated with a ground state transition. Gamma-gamma-coincidences, denoting cascade emission of gamma-rays by the excited residual nucleus, were observed, but no beta-beta-coincidences were found.

2043 Shape of the Beta-Spectrum of the Forbidden Transition of Yttrium 91 by Lawrence M Langer, and H Clay Price Jr Phys Rev 75 1109 (1949) Apr 1 (Letter to the editor)

The momentum distribution of the negatrons emitted in the 57-day disintegration of $_{39}Y^{91}$ has been determined using a high resolution magnetic spectrometer, as being different from the spectrum expected for an allowed transition. The exact shape of the spectrum gives confirmation for the shell structure model of the nucleus and for the validity of the Gamow-Teller selection rules. A conventional Fermi plot of the data is shown, which is not the straight line characteristic of allowed transitions and which has been found for many presumably forbidden transitions. A maximum energy release of 1.53 Mev is indicated. The theoretically expected forbidden Fermi plot is obtained, however, by dividing the ordinates of the conventional plot by a factor suggested by Feenberg and Hammack's shell structure analysis (private communication).

SCIENTIFIC RESEARCH AND LABORATORIES

2044 The Los Alamos Scientific Laboratory by J H Manley Bull Atomic Scient 5 101-103 and 105 (1949) Apr

The types of research being carried out in the various divisions of the Los Alamos Scientific Laboratory are described and the laboratory policy is discussed with respect to the professional activities and living conditions of the scientists employed there.

2045 Unclassified Researches in Nuclear Physics at Chalk River - 1948 by W B Lewis. National Research Council of Canada CRR-401 Nov 24 1948 23p

The outstanding facility for nuclear physics research at Chalk River is the high flux of neutrons afforded by the heavy water pile. This flux, which at the center amounts to 3×10^{13} thermal neutrons/cm^2/sec is believed to be the highest available anywhere in the world for experimental purposes. This flux can, of course, be used only for very special experiments which can be done in the interior of a pile. Other sources of radiation include a two million volt x-ray machine and a 50 kv positive ion accelerator. Major items of experimental equipment include a range of β-ray spectrometers for studying β-rays over the energy range from about 15 Kev to 12 Mev. There is also a pulse amplitude analyzer or "Kicksorter" having 30 channels. A system containing a large number of counter tubes has also been successfully used in studies of cosmic rays. Research work on the following is reported: B^{10} and B^{11}, gamma rays from neutron capture, cosmic rays (the decay of the meson), fission of uranium isotopes by slow neutrons, standardization measurements of radioisotopes and radiation exposures, detectors of radiation with high discrimination, and mass spectrograph and quartz fiber instruments.

SPECTROSCOPY

2046 Use of Fluorothene in Infrared and Raman Spectroscopy by J S Kirby-Smith and E A Jones. AECD-2563 (KLI-148) Feb 7 1949 Decl Apr 18 1949 5p Proposed for publication in Rev Sci Instr

The recent development of fluorothene plastic (polymerized monochlorotrifluoroethylene) now makes available a material for absorption and scattering cells of superior chemical resistance. The advantages

SPECTROSCOPY (continued)

of this material over the fully fluorinated compound (Teflon) are optical transparency, availability of a chemically resistant sealing wax (fluorothene-W) and the thermoplastic properties of the material which allow it to be welded. Some methods of fabricating fluorothene Raman tubes and infrared cells are outlined.

2047 Rotational Absorption Spectrum of OCS by M W P Strandberg, T Wentink Jr and R L Kyhl. MIT Research Laboratory of Electronics Technical Report No. 59 May 13 1948 19p (NP-141)

Extended measurements in the microwave rotational spectrum of carbonylsulfide (OCS) are presented and correlated with the data obtained by other investigators. Precision measurements of rotational transitions for $J_1 \longrightarrow 2$, $J_2 \longrightarrow 3$, $J_3 \longrightarrow 4$, $J_4 \longrightarrow 5$ allow the evaluation of precise reciprocal moments of inertia in the ground vibrational state, and the centrifugal distortion coefficient. From frequencies observed for $O^{16}C^{12}S^{32}$, $O^{16}C^{13}S^{32}$, and $O^{16}C^{12}S^{34}$, internuclear distances have been calculated. Equilibrium moments of inertia and internuclear distances cannot as yet be given, since thus far only one of the three vibrational-rotational interaction coefficients (α_2) has been reported. Theoretical considerations involving such equilibrium data are discussed. Data on l-doubling in $O^{16}C^{12}S^{32}$, $O^{16}C^{13}S^{32}$, and $O^{16}C^{14}S^{32}$ are presented. The Stark effect of carbonlsulfide has been measured in $O^{16}C^{12}S^{32}$ and $O^{16}C^{13}S^{32}$. These measurements lead to the evaluation of the dipole moment and indicate the effect of isotopic changes on the dipole moment.

TRACER APPLICATIONS - BIOLOGY

2048 Tryptophan Metabolism I. Concerning the Mechanism of the Mammalian Conversion of Tryptophan into Kynurenine, Kynurenic Acid and Nicotinic Acid by Charles Heidelberger, Mary E Gullberg, Agnes Fay Morgan and Samuel Lepkovsky. AECU-182 (UCRL-308) Mar 15 1949 13p (See also AECD-2069)

Experiments with radiocarbon prove that dl-tryptophane is converted into kynurenine in rabbits and kynurenic acid in dogs. The β-carbon atom of the tryptophane becomes the β-carbon atom of kynurenine and the 3-carbon of kynurenic acid. Thus, the conversion takes place by only one mechanism. The administered dose of tryptophane is considerably diluted by the body pool of this substance and other intermediates. The side-chain of tryptophane is lost during its conversion into nicotinic acid. This document is an amplification and revision of AECD-2069.

2049 Tryptophan Metabolism II. Concerning the Mechanism of the Mammalian Conversion of Tryptophan into Nicotinic Acid by Charles Heidelberger, Edward P Abraham and Samuel Lepkovsky. AECU-183 (UCRL-309) Mar 15 1949 9p (See also AECD-2069)

The conversion of tryptophane into nicotinic acid in the rat has been established with certainty by isotopic experiments. The mechanism of this change is identical to that previously shown for Neurospora and consists of a sequence in which the principle compounds are: tryptophane, 4-kynurenine, 3-hydroxyanthranilic acid and nicotinic acid. Carbon atom-3 in the indole ring of tryptophane, the precursor of the carboxyl carbon of the 3-hydroxyanthranilic acid, becomes the carboxyl carbon atom of the nicotinic acid. This document is a revision and amplification of AECD-2069.

2050 The Fate of C^{14}-Labeled Palmitic Acid Administered Intravenously as a Tripalmitin Emulsion by S R Lerner, I L Chaikoff, C Entenman and W G Dauben Proc Soc Exptl Biol and Med 70 (1949) Mar

Palmitic acid labeled at its sixth carbon with C^{14} has been used to study the path of utilization of intravenously introduced fat. The acid was injected into fasted rats in the form of triglyceride. It was found that from 36 to 59% of the administered C^{14} was expired as CO_2 in 24 hours and that considerable amounts of the administered fatty acids were stored in adipose tissues throughout the body. The fact that 78% of the radioactive fatty acids recovered from the liver and small intestine had been incorporated into phospholipids is interpreted as constituting further evidence that intravenously administered tripalmitin is readily available for metabolic purposes.

TRACER APPLICATIONS - BIOLOGY (continued)

2051 Further Studies of the Circulation with Radioactive Erythrocytes by G Nylin and S Hedlund Amer Heart J 37 543-550 (1949) Apr 1

The circulating corpuscular volume has been determined using red cells labelled with radioactive phosphate. 1) Injected labelled red cells remain constant in their activity for at least one hour after injection. The activity of labelled plasma, when given by itself, decreases very rapidly. On the other hand, the radioactive phosphate from the plasma enters very slowly into the corpuscles and reaches a maximum in the corpuscles about 5 hours after injection. It seems to be a normal finding that the activity of the red cells and also of the plasma is the same about 60 minutes after injection. 2) Double injections of whole blood, the second injection being given about 30 minutes after the first injection, give the same calculated blood corpuscular volume as determined from the first injection. This can be used as a control. 3) With the help of the injected labelled corpuscles it is possible to calculate the minute volume of the heart and the thoracic pool of blood from the dilution curve in the arterial blood. An empirical method for the determination of the amount of residual blood in the heart, the cardiac output, and the thoracic pool of blood, using the dilution curve for the arterial blood is formulated. 6 curves 19 references.

2052 Metabolism of Isocysteine, Labeled with Radiosulfur (S^{35}), in the Rat by D D Dziewiatkowski and W J Wingo Proc Soc Exptl Biol and Med 70 448-450 (1949) Mar

The oxidation of the sulfur of isocysteine in the rat has been studied using isocysteine labeled with S^{35}. Only a small amount of the S^{35} was excreted as sulfate in the urine within 24 hours after administration of the compound by stomach tube or by intraperitoneal injection, whereas a much larger portion was excreted as organic sulfur. A very small fraction of the S^{35} was recovered in the feces and intestinal contents of the rats. The results of these experiments have been compared with those obtained in earlier investigations in which rabbits were used [Wingo and Lewis, J Biol Chem 165 339 (1946)]. The rabbits excreted "extra" sulfur equivalent to only 29 to 37% of the dose given by stomach tube within 24 hours, while on the other hand 76 to 98% was excreted when subcutaneous administration was used. The rats, however, excreted only about 52% of the isocysteine which had been injected intraperitoneally.

2053 The Radioactive Isotopes in Biology and in Medicine (Les isotopes radioactifs en biologie et en médecine) by Jean Govaerts Acta Physiotherapica et Rheumatologica Belgica 3 283-294 (1948) (In French)

The principles of the techniques employed in using radioactive indicators as well as a few of the refinements of these techniques are reviewed briefly and some of the biological and medical applications of radioactive isotopes at the Centre de Physique Nucléaire at Liége are described. In the preliminary treatment of general techniques the method and the sensitivity of measurements are discussed and some of the factors involved in choosing a suitable indicator are mentioned. The use of radiophosphorus in such studies, the developments in autoradiography, and the therapeutic utilization of iodine-131 are discussed in some detail.

2054 A Simplified Method for the Determination of Circulating Red-Cell Volume with Radioactive Phosphorus by E B Reeve and N Veall J Physiology 108 12-23 (1949) Mar 1

The total red-cell volume in man has been measured from the dilution of injected washed red cells which had been labelled in vitro with P^{32}. The red cells were prepared by incubating whole blood with P^{32}, after which they were washed almost free of their radioactive plasma. Following injections of suspensions of such washed red cells, P^{32} is slowly lost from the circulation. A specially designed Geiger-Müller counter was used which takes liquid samples [Brit J Radiology 21 347 (1948)]. The results obtained were compared in tabular form with the results given by the T1824 haematocrit method and were also checked in vitro. In both cases good agreement was obtained. It is calculated that even if several red-cell estimates are made on the same subject using the method described, there is little risk from the radiation dosage involved.

TRACER APPLICATIONS - CHEMISTRY

2055 Applications of the Radioindicator Method in the Study of Chemical Reactions in which Solids are Among the Reagents (Sur l'application de la méthode des radioindicateurs à l'étude des réactions chimiques où interviennent des solides) by P Daudel, R Daudel and M Martin Bull Soc Chim France 1949 D 69-D 70 (1949) Jan-Feb (In French)

A method is outlined in which artificial radioelements are used for the evaluation of ion exchanges between an insoluble solid and a salt solution, both having one ion in common. Among examples given are exchanges in systems of arsenic-including ions, and halogen-ion exchanges in certain chromatographic procedures.

2056 International Symposium on Isotope Exchanges and on Molecular Structure (Éschanges isotopiques et structure moléculaire Colloque international) J Chim Phys 45 141-188 July-Aug; 193-249 Sept-Oct (1948)

The Symposium was held in Paris on April 5-10, 1948. The following is a list of all the papers read. The papers are published in the present issues of the Journal, together with the essential parts of the discussions that followed the presentation of the papers. The Structure of Complexes and Its Influence on Exchange Reactions, by L. Pauling (In French); Exchange Reactions and Electrolytic Dissociation, by C. Evans and S. Sugden; Isotopic Exchange Reaction and Electronic Structure of Substituted Aromatic Hydrocarbons, by B. Pullman, P. Rumpf, and F. Kieffer (In French); A Study of Valency States of Products of β-Disintegration and Isomeric Transition, by W. H. Burgus, T. H. Davies, R. R. Edwards, H. Gest, C. W. Stanley, R. R. Williams, and C. D. Coryell (In French); Ions Formed by the Reaction (n,γ) in Sodium Arsenite or Sodium Arsenate, and in Sodium Cacodylate, by P. Sue (In French); On Chemical Reactions Taking Place During Nuclear Reactions That do not Change the Nature of the Atoms, by P. Daudel, R. Daudel, S. May, R. Muxart, and O. Chalvet (In French); Behavior of Certain Perfect Cobalt Complexes in the Szilard Effect and in the Exchange, by P. Sue and G. Kayas (In French); The Determination of Some (α,n) Reactions by the Szilard-Chalmers Effect, by E. Broda (In French); The Szilard-Chalmers Effect Produced by Neutrons of Various Energies, by E. Broda (In French); Kinetic Studies on Isotopic Exchange Reactions, with Some Remarks on their Relevance in Classification of Types of Chemical Bonding, by M. D. Kamen, J. W. Kennedy, and O. Myers; Ion Exchange Between Crystal Surfaces and Solutions, by F. Paneth (In French); Exchange Between Metals and their Ions in Solution, by M. Haissinsky, M. Cottin, and B. Varjabedian (In French); Relationship Between Exchange Phenomena and Electrochemical Phenomena, by M Haissinsky (In French); Isotope Exchange and Mechanisms of Heterolytic Substitution, by S. K. Hsü, C. K. Ingold, C. G. Raisin, E. de Sales, and C. L. Wilson; Free Valence in Organic Reactions, by C. A. Coulson; General Conclusions, by G. Hevesy (In French).

TRACER APPLICATIONS - INDUSTRY

2057 Proceedings of the Conference on Industrial Uses of Radioactive Isotopes, Ottawa, Ontario, December 7, 1948 by G H Guest. National Research Council of Canada Report CRIB-405 Jan 1949 55p

The following papers are included: Radioactivity by D A Keys (general lecture on radioactivity); Putting Isotopes to Work in Industry, by G H Guest (applications of radioactive isotopes); and Health Precautions, by M T Beam (potential health hazards in working with radioactive material and methods and equipment used to control hazards.

TRACER APPLICATIONS - PHYSICS

2058 Determination of the Solubility of Silver Bromide in Nitric Acid Solution Using Radiobromine by Roswell Ruka and J E Willard J Phys and Colloid Chem 53 351-357 (1949) Mar

Determinations of the solubility of silver bromide have been made by equilibrating small (~0.025 mg.) samples of precipitated silver bromide containing radiobromine with a few milliliters of solution and counting aliquots of the supernatant. The solubility in 1 N to 0.3 N nitric acid is very nearly identical

TRACER APPLICATIONS - PHYSICS (continued)

(i.e., about 0.1 mg/l.) with the solubility in neutral solution reported by earlier investigators using other methods. The temperature coefficient of solubility for the range of 0°C to 25°C in 1 N nitric acid is also the same as that previously observed in neutral solution by another method. The method used in this work gives high values for the apparent solubility in neutral solution, probably owing to peptization of the precipitates.

TRANSURANIC ELEMENTS

2059 Products of the Deuteron and Helium Ion Bombardments of U^{233} by E K Hyde, M H Studier and A Ghiorso. AECD-2572 (CB-3736) Dec 3 1946 Decl Apr 18 1949 27p For publication in NNES

Information concerning the lighter isotopes of neptunium and plutonium has been obtained by studying the products of the bombardment of U^{233} with deuterons and helium ions from the 60-inch cyclotron. Np^{234} is shown to be an orbital-electron capturing isotope of 4.40 ± 0.05 days half-life with an associated gamma ray of 1.9 Mev energy. Evidence is presented that the isotope Pu^{234} decays by the emission of alpha particles of approximately 6.0 Mev energy with an apparent half-life of 8 ± 4 hours. Pa^{230} is shown to be produced by a d,αn reaction, a type of nuclear transformation hitherto unknown. By correlation of information from these bombardments, with information obtained by others (James et al "Products of the Helion Ion and Deuteron Bombardments of U^{235} and U^{238}", PPR Vol 14B No. 22.8) from bombardments of U^{233}, Np^{235} is identified with an 8.3 month orbital-electron capturing isotope and Pu^{237} is identified with a 40 day orbital electron capture decay. From the failure to find any evidence for plutonium isotopes of mass 231, 232, 233, and 235, and for neptunium isotopes of mass numbers 231, 232, and 233, some conclusions regarding their half-lives are reached.

2060 A Tracer Study of the Valence States of Neptunium by A F Voigt, N R Sleight, R E Hein and J M Wright. AECD-2575 (ANL-JJK-14B-64) nd Decl Apr 20 1949 14p For publication in NNES

Studies have been made on the carrying of neptunium tracer on zirconium phenylarsonate in the presence of various oxidizing and reducing agents. The precipitate which is quite specific for even-valent ions, particularly quadrivalent ones, carries neptunium better from reducing solutions than from oxidizing solutions. The evidence can best be met by a proposal that the two lower valences stable in solution are (IV) and (V). Duplicate experiments with plutonium tracer bear this out since the behavior of the plutonium is quite different from that of neptunium. Extraction methods tried for determining the valences were unsatisfactory.

URANIUM AND URANIUM COMPOUNDS

2061 U-235 Gamma Radiation by R L Macklin. AECD-2564 (KLI-164) nd Decl Apr 18 1949 4p Proposed for publication in Phys Rev

Evidence for the existence of a gamma ray accompanying the alpha decay of U-235 is presented. The energy of the gamma ray, as determined by several independent absorption measurements, is 162 Kev.

2062 Adsorption of Uranyl Salts on Solid Adsorbents by Y M Tolmachev Izvest Akad Nauk SSSR No. 1 28-34 1943 (NP-742)

A study was made of the adsorption of uranyl nitrate from aqueous solutions onto charcoal and various schists. On charcoal the uranyl ion is adsorbed reversibly according to Freundlick's law. On schists the uranyl ion adsorption is irreversible. The comparison of the adosrption capacity of the schists from Leningrad Province with their uranium contents shows that the process of accumulation of uranium in these schists during the corresponding geological period was essentially an adsorption of uranyl ions from aqueous solutions.

URANIUM AND URANIUM COMPOUNDS (continued)

2063 The Crystal Structure of Barium Uranate: the Absence of UO_4 Groups (Die Kristallstruktur des Bariumuranates Nichtexistenz der UO_4-Gruppe) by Sten Samson and Lars Gunnar Sillén Arkiv Kemi Mineral och Geol 25 Paper No. 21, 1-16 (1948) (In German)

Uranium differs from the related Cr, Mo, and W in that all uranates are insoluble, while alkaline chromates, molybdates, and wolframates are, as a rule, readily soluble. The authors assumed that this striking difference was related to the increasing radii of the 6-valency ions, from Cr to U: whereas CrO_4 groups are probably well developed in the chromates, and the corresponding tetraeders are known to show certain deformations in molybdates and wolframates, the radius of the U ion must be too large to allow of a stable tetraeder grouping of the O ions. This assumption was tested experimentally on $BaUO_4$, (it was proposed to use BaU_2O_7 in the near future). A complete lattice determination was made, which confirmed the predicted absence of UO_4 groups. This structure should account for the non-solubility of the uranates.

2064 Study of Oxide of Uranium "Thermistors" (Étude des "thermistors" a l'oxyde d' uranium) by Jacques Prigent J Phys et Radium 10 58-64 (1949) Feb (In French)

Some attempts to prepare oxide of uranium thermistors are described. (Such thermistors are used to detect infrared and ultrahertzian radiations.) The methods of preparation of UO_2 are described and the data obtained on various properties of the pastes of uranium oxide, i.e., resistance and the influence of applied force, temperature and pressure, are given in the form of several curves. The practical application of the samples obtained has not been very satisfactory and thus other oxides are usually used.

2065 Vibrational Fine Structure in the Absorption Spectra of Uranyl and Plutonyl Ions in Aqueous Solution by M Kasha J Chem Phys 17 349 (1949) Mar (Letter to the editor) (See also MDDC-591 and -892)

A section of the absorption spectra obtained for uranyl and plutonyl ions in aqueous solution is shown. Analogous absorption bands centering about 4100 A have been found in both cases corresponding to forbidden electronic transitions and further distinguished by discrete, though diffuse, regular vibration structures.

VACUUM SYSTEMS

2066 An Investigation on Hot-Wire Vacuum Gauges II by Hans von Ubisch Arkiv för Matematik, Astronomi och Fysik 35A Paper No. 28 (1948) Sept 21 12p

The practical aspects of the design of hot-wire vacuum gages are discussed and gages having different ranges are described. Calibration curves are given and several applications are mentioned. A needle-valve type gage sealed with rubber packings is described.